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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS.
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 20.

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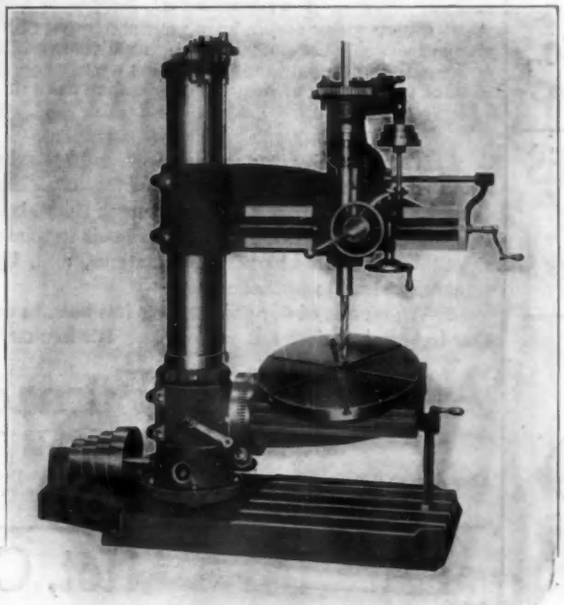

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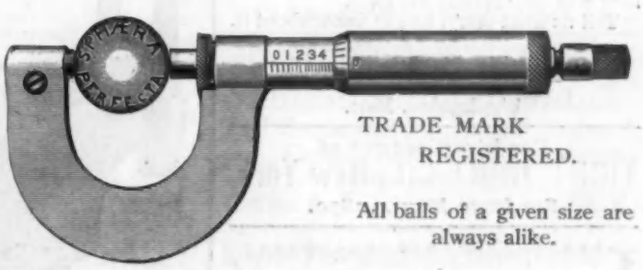

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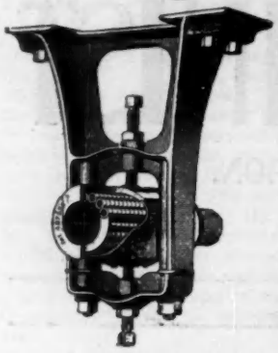

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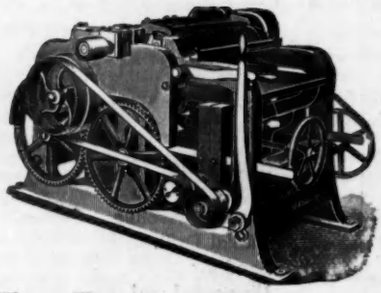

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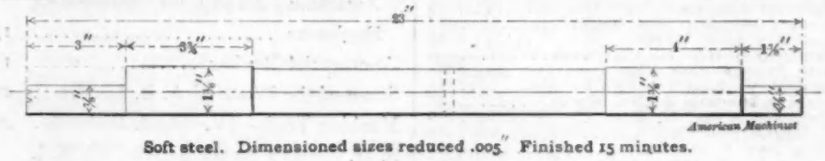

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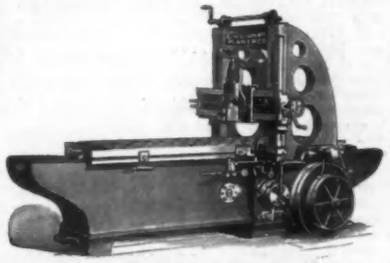

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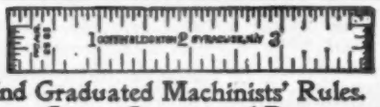

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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, MAY 18, 1899 NUMBER 20

Published at 218 William St., New York
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

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Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Never address individuals, send all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price.

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$4 per year in foreign countries, postage prepaid.
No back Numbers beyond current year.
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Tripler's Liquid Air.

Tripler is quoted as saying in the course of a recent lecture: "The great utility and ultimate economy of liquid air will be in the fact that it can be used at ordinary temperatures with as great, or greater effect than steam. It requires a heat of 212 degrees to get steam power out of water, but if liquid air is used, no application of heat is necessary in order to develop a far greater pressure than is possible with steam. If used in ordinary temperatures it will develop immeasurable force. Nothing could possibly be more economical." Pointing to the two carboys of liquid air on the stage, he said: "If this amount of liquid air were put into the engines of the 'Campania,' those engines would either go round or go through the ship."

The same may be said for liquid nitroglycerine, and the statement means nothing whatever as to the economy or usefulness of liquid air as a motive power. Whether Tripler is simply ignorant or a conscious humbug, is open to question. It is obvious that his statements must be explained on one or the other hypothesis.

The Thirty-ninth Meeting of the American Society of Mechanical Engineers.

The convention opened Tuesday evening, May 9, by a reception at the Corcoran Art Gallery, the members being received by President Melville, Secretary of the Navy Long, and by Mrs. Westinghouse. The address of welcome was by Col. A. T. Bingham, U. S. Engineer, in charge of buildings and grounds. He spoke of the many beautiful sights of Washington, and expressed regret that the society would be unable to meet the President, as had been planned. The remainder of the evening was passed in a very enjoyable manner in viewing the pictures and sculptures of the gallery.

Wednesday Morning's Session.

The first session for the transaction of business convened in the assembly hall of the Arlington Hotel. The treasurer's report was presented, followed by the reading of invitations from the Cincinnati League and from the Mayor of Cincinnati to hold the next spring meeting there. These invitations were referred to the Council.

The first professional business taken up was the report of the Committee on the Revision of the Society Code of 1885, relative to a standard method of conducting steam boiler trials.

This report was presented in incomplete form for discussion at the meetings of last spring and fall. It is now presented in complete form for final approval by the membership. It represents an enormous amount of labor on the part of the committee, and will doubtless establish a new standard of practice in boiler testing. The report was received with surprisingly little discussion, considering its subject—a fact which can only be taken as indicating that it is now in a form which is satisfactory to the membership. A few suggestions were made which the committee promised to take into consideration, and some very fitting acknowledgements of the immense amount of work involved were made.

The Committee on a Standard Method of Conducting Steam Engine Trials stated that the committee had organized and had opened extensive correspondence with engineers and engine builders, both at home and abroad, which had demonstrated a wide interest in the subject. The committee hoped to be able to present a written report at the fall meeting, but at present could only report progress. The first regular paper to be presented was entitled

Standards for Direct-Connected Generating Sets.*

BY J. B. STANWOOD.

The author of this paper points out the havoc in standardized engine construction and in manufacturing methods that has been brought about by the direct-connected generator set which, having been designed without reference to the engine which is to drive it, calls for a special construction in almost every case. He points out the few dimensions that would require standardization in order to overcome this source of expense, and concludes by making a motion requesting the Council to communicate with the American Institute of Electrical Engineers, with a view to the appointment of a joint committee to determine and recommend a set of standard capacities, speeds and dimensions of those parts affected by the combination.

The paper was greeted with marked applause, and in the discussion much sympathy with the author's position was shown. Representatives of both the engine and dynamo-building industries took part, and in general agreed that there was no great difficulty in deciding upon a set of standards which should accomplish practically all that the author aimed at. Such difficulties as were urged were mainly by those not engaged in actual manufacturing, and need not be considered serious. It was made plain that the proposed set of standards would assist the electrical quite as much as the mechanical side of the combination. Mr. Forbes said that a similar movement was now on foot abroad, and that this society should move promptly if American industries were to reap the full advantages of the movement. At the conclusion the author's motion was carried unanimously.

The second paper was on

Boiler and Furnace Efficiency.

BY R. S. HALE and W. B. RUSSELL.

The authors of this paper set forth that in most boiler tests the efficiency of the boiler only has been determined, whereas they claim that observations should be made sufficient to determine the furnace efficiency, the efficiency of transmission and the efficiency of utilization—the pro-

*Printed copies of all papers may be obtained at small cost by addressing the Secretary of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York.

duct of these three factors forming the boiler efficiency.

A large number of boiler tests are then tabulated and analyzed in order to discover some law which these various efficiencies follow. Deductions regarding the merits of different types of boilers from these general standpoints are then drawn, the horizontal tubular boiler being given the preference as being "the type of boiler for best economy of steam production, although the internally fired boilers are probably as good if the furnace is roomy and the firing careful."

The discussion of this paper was more in line with the traditions of the society regarding boiler papers than that of the committee report had been. Statements and counter statements, opinions and counter opinions, flew freely, all showing, to one who is not especially interested in the subject, how at sea most deductions regarding the action of boilers are, and how hopeless the analysis of boiler tests seems to be. The paper was especially criticised because some of its conclusions were based on insufficient data, and the criticisms were accepted by the authors with the explanation that in these cases they had simply done all they could with the available data.

The concluding paper of the morning session related to a

Test of a Steam Separator.

BY F. L. EMORY.

This paper records a test of a steam separator of the baffle-plate type for efficiency in separating both water and oil from steam. The tests show that for the higher velocities of steam flow this separator will deliver steam of about 97 per cent. dryness—the action being substantially constant with steam of widely varying pressures.

Used as an oil separator the test shows the apparatus to remove about 52 per cent. of the oil in the steam.

In the discussion, the opinion was expressed, without contradiction, that the oil recovered by separators was of little or no value as a lubricant. Mr. Boyer described a form of separator which he had used with success, consisting of a large closed tank fitted with baffle plates and filled with broken brick, stone or coke. Used in connection with a surface condenser this form of apparatus, he claimed, will deliver the water sufficiently clean to be used in the boiler again, which he claimed the patented separators would not do. So far as effectiveness of separation was concerned there was little choice in the material to be put in the tank, but inasmuch as the residue had to be gotten rid of, he preferred to use coke, as the residue could then be burned with the coke.

Wednesday Evening's Session.

The first paper of this session was on

Investigations of Boiler Explosions.

BY GUS. C. HENNING.

After a statement of the leading causes of boiler explosions the author proceeds to argue in the most positive manner that investigation should always be sufficient to determine the cause of an explosion. In the words of the author, "careful testing with proper means and apparatus, added to thorough superficial inspection, will always be sufficient to demonstrate the cause of any boiler explosion."

In reply to queries raised in discussion the author showed by diagrams on the blackboard the effect on the stress strain diagram of various kinds of abuse of boiler plate.

Following this came a paper on the

Relation Between the Initial Tension and Power Transmitted by a Belt.

BY F. L. EMORY.

We have here the old-time analysis of the action of belts, based on the assumption that the sum of the tensions on the tight and slack sides is constant—an assumption that is now entirely discredited by the experiments of Wm. Sellers & Co. Even were this assumption not discredited, there would seem to be no excuse for the re-publication of an analysis which can be found in all books on the subject. The only part of the paper which can be considered at all new is a pair of diagrams in which the formula is put in graphical form. Considering, however, that the fundamental assumption of the formula has been disproved, little or no real value can be placed on the diagrams.

The only discussion of the paper was by Mr. Wilfred Lewis, who criticised both the fundamental assumptions and the mathematical analysis of the paper. He showed the great uncertainty regarding the value of the coefficient of friction, and pointed out the importance of the effect of centrifugal force at high speed.

The third paper was entitled

Experiences With Deep-Well Pump Rods.

BY G. W. BISSELL.

The deep well which furnished the experiences in this paper is one which constitutes the principal water supply of the Iowa State College, at Ames, Iowa. The well has a total depth of 2,215 feet, and the pump is hung at a depth of 300 feet. It is known as the Johnson continuous-flow pump, having a single vertical cylinder with two alternately lifting pistons, each piston having a quick-return movement and beginning another lifting stroke before the lift of the other piston ceases, so that the water is kept in continuous upward movement. The rod for the lower piston was inside the rod for the upper piston. In a few months after starting the pump the rods gave out, chiefly on account of the wearing of the outsides of the screw couplings by which the lengths were connected. The paper tells of the renewing of the couplings and the providing of brass-winged guides upon the rods to prevent their abrasion.

The principal point brought out in the discussion was the advisability of using wood instead of iron pump rods. The effect of using wood is to save the iron casing pipe at the expense of the wood rods, which are easily removed and replaced.

Following this came a paper on

Pipe Flanges and Their Bolts.

BY A. F. NAGLE.

This paper is a discussion of the retaining pressure produced on gasket joints by the bolts. The author shows that for high fluid pressures these retaining pressures with plain flanges are inadequate, and advocates the use of joints having a groove in one flange for the reception of narrow gaskets with a tongue on the mating flange projecting into this groove. The paper concludes with tables giving the pressure per square inch on gaskets of both types—the figures for the tongue and groove type being given for the Chapman & Crane standard flanges, as well as for a standard proposed by the author.

The author also advocates the laying out of steam pipes in such a manner that the strains due to expansion and contraction shall be met by torsion instead of flexure sections of the pipe, and gives a design of torsion section devised by himself.

The paper brought out the most animated discussion of any paper presented thus far. This discussion showed plainly that with increasing pressures the question of pipe joints has come to be a serious one. The president stated that during the late unpleasantness with Spain, the pipe flanges of the ships of the navy made more trouble than any other feature. Many members gave sketches of successful joints which they had used. Several emphasized the opinion that the present flanges were much too light and had too few bolts. Others expressed the opinion that the use of cast-iron fittings in connection with steel pipe was incongruous and should be discontinued.

The concluding paper of the evening was on

The Manufacture of Car Wheels.

BY G. R. HENDERSON.

The author of this paper gives an excellent account of the scientific knowledge now brought to bear on the manufacture of chilled iron car wheels. So recently as fifteen years ago the practice was entirely empirical, while at the present day the entire work is surrounded by chemical and physical tests. While it cannot be said that the effects of all the constituents of what we call cast iron on the strength and wearing qualities of the wheels have been determined, it is nevertheless clear from Mr. Henderson's paper that much progress has been made, and many of the former uncertainties which surrounded the business have been removed. Thus he says, "Indeed, cracked plates are almost a

(*Continued on page* 441.)

Commercial Review.

NEW YORK, SATURDAY EVENING,

May 13, 1899.

ELECTRICAL MACHINERY.

Heavy demand for motors for industrial purposes is reported by the companies which make more or less of a specialty of that line. Orders of that class are generally for small lots, but they fill up a big aggregate. Despite the approach of summer, business in this department seems to be growing, rather than falling off. As a whole, the electrical field looks about as attractive this month as it did last, despite the fact that this is an off season of the year for lighting dynamos.

The combinations of electric illuminating and power companies in this locality, with the promised reductions of rates for the use of current, has a tendency to cause hesitation on the part of individuals who have contemplated installing isolated plants. On the other hand it is predicted to exert a stimulating influence in the motor trade, because of the cheapening of electric power.

Although, from time to time, since the advance in the copper market many of the electric companies have raised the prices of machinery, the General Electric Company had not done so materially until this week. The 10th instant, however, it made an advance of 10 per cent., which is stated to apply to all of its products except incandescent lamps. The further statement is made that this advance does not more than half compensate for the increased prices of raw materials, and that the company has decided to share the burden of these equally with the public. The Westinghouse Electric & Manufacturing Company is understood to have advanced prices some time before the General Electric. The officials of another company are now earnestly discussing the price question, and following the precedent of their competitors, will probably make a definite increase shortly.

As a result of greater cost of raw material the German electrical manufacturers have announced a 5 per cent. advance in the prices of various products. This took effect May 1. Their circular announcing it is signed by the following firms: Siemens & Halske, the General Electric Company, of Berlin; Schukert & Co., of Nuremberg; the Helios firm, of Cologne; Krumner, of Dresden; and Lahmeyer & Co., of Frankfort. These firms are keenest competitors of American manufacturers, principally in Russia and Southern Europe.

Two foreign contracts of note which the General Electric Company now has on hand are for plants to be shipped to Sao Paolo, Brazil, and to Regla, a suburb of Havana, Cuba. Each comprises material for railway and lighting purposes. The Metropolitan Street Railway Company, New York, is buying additional material from the General Electric Company almost daily. Fifty car equipments were ordered one day last week. The North Jersey Street Railway Company is also placing some good-sized orders. Last week sixty-two big double equipments were called for and a contract for thirty more has probably been closed by the end of this week.

The Bullock Electric Manufacturing Company will furnish the Pacific Coast Borax Company for its Bayonne, N. J., plant, with 175 horse-power of additional motors, ranging from 10 to 100 horse-power in size.

According to a prominent official of a company which is devoting much attention in a quiet way to the export field, foreign trade of this year is developing far better than last year. Orders are coming in heavily from England and elsewhere in Europe and out of it. A large contract recently closed includes electrical machinery for lighting and power purposes, for shipment to Russia.

The C & C Electric Company finds English trade especially brisk. A recent order from that country includes a 120-kilowatt generator and 125 horse-power in motors. A 30-kilowatt generator has been sold for lighting a club house in Yokohama, Japan.

The Crocker-Wheeler Company is filled with orders, some of them noteworthy. Among them are contracts for the equipment of the Pennsylvania Railroad Company's shops at Hoboken, N. J., with nearly thirty 110-volt motors; of a street railway company at Rochester, N. Y., with two 200-kilowatt generators, etc.; and of the Pencoyd Iron Works, Pencoyd, Pa., with 105 horse-power of 220-volt motors. For the Sayre & Fisher Company, Sayreville, N. J., have lately been installed a 250-kilowatt 550-volt generator, with motors for operating brick machines and pug mills. Four 100-kilowatt dynamos, required by the United States Government, are being shipped to Havana, where it is thought that they will be used for a disinfecting plant. The 400-kilowatt generator now on exhibition at the electrical show, together with another of the same size, and considerable smaller machinery, is destined for the Smelting Corporation, Limited, Ellsmere Port, England.

MISCELLANEOUS.

The Webster Manufacturing Company has taken an order to supply all the machinery for a 500,000-bushel grain elevator of the Intercolonial Railway, Halifax, N. S. It amounts to about $20,000. A contract has also been closed to furnish all the elevating and conveying machinery for a new Portland cement plant at Siegfried, Pa., of the Lawrence Cement Company, N. Y. This plant has a capacity of 25,000 barrels a day, and the Webster Company believes the order to be the largest for elevating and conveying machinery that has ever been let in the East.

CHICAGO MACHINERY MARKET.

There is rumor, not well defined, but of the character that feeds best perhaps upon theory rather than fact, that the large Western railway systems will soon begin the manufacture of cars on a much more extensive scale than they have ever done before. The reason offered for this innovation is that the combined car builders have so advanced prices of cars that the carriers expect to find the manufacture of their equipment more economical than its purchase from outside builders. If this rumor proves true there will probably be a large demand for machinery from the railways. It has not yet appeared. The carriers have been buying generously, but it has been mainly for their repair shops, in which operations have been very active for many months. The Santa Fé road has been one of the best buyers of machinery in this market for a considerable time, picking up a large number of tools and from a great many sellers. One of the Western roads is even credited with the serious consideration of erecting a small rolling mill, with which to roll into bars the heavy tonnage of scrap which it every year produces. This new trend of thought in railway mechanical practice is stimulated by the changing conditions wrought by the combinations of previously independent producers.

Among dealers in machinery the statement is now quite commonly heard that prices are more stable. There are some advances, but they are fewer. It is said, further, that some of the factories are now beginning to catch up with their orders, and that the situation is thus becoming easier in regard to supplies. This supposed condition, however, is not general. Indeed among the better class of makers the array of orders with which they are now confronted shows little if any indication of decrease. May trade, on the whole, is not quite up to the standard of April. This may be merely one of the unexplainable and brief periods of quiet in the midst of a busy season, or it may be accounted for by the early beginning of the spring trade, to be naturally followed by an early close, for, however active the trade may be, the relative value of brisk and quiet months is maintained. Inquiries continue, but the buying is less responsive to the quotations that are named. In some quarters it is intimated that the advances in prices are exerting a dulling effect upon trade, but this is inference drawn from the backwardness displayed by the inquirers. Ordinarily present trade would be alluded to in eulogistic terms. It is shadowed only by the recent record-breaking months.

Wood-working machinery has preserved a more even range of prices. The volume of trade has been fair and continuous. Collections are excellent, one large seller reporting that not in months has he had from his customers a request for a deferred payment beyond sixty days. For

band saws and similar goods the market is very active and bare.

The Niles Tool Works have sold to a large Milwaukee manufacturer a 16x24-foot boring and turning mill. The Chicago business of this company for April was the largest for any one month since January, 1891, with the single exception of December, 1898.

Bement, Miles & Co. have been doing a large trade, especially in steam hammers, one recent sale being a 2,000-pound hammer to A. Finkl & Son, of this city.

PHILADELPHIA TOOL NOTES.

Seldom if ever before have the Philadelphia tool-building shops been as busy as they are now. Some of them are occupied mainly with domestic orders, and in some cases the home business alone is declared to be better than ever before seen. Where concerns have been reaching out for foreign business, as most of them have, however, there is a good foreign trade. Bement, Miles & Co. are just finishing a lot of seven gun lathes, built for Vicker's Sons & Maxim, of Sheffield, and near these on their floor is a very large planer to go to Warsaw, Poland, besides other heavy tools destined for various points in Europe.

Sellers & Co. are building tools considerably heavier than any that have preceded them, and are arranging for increasing their shop room.

Edward Harrington, Son & Co. are also busy on tools, and cannot keep up with their orders in hoists.

MACHINERY EXPORTS FOR MARCH.

The "Monthly Summary of Commerce and Finance," compiled by the Bureau of Statistics, Treasury Department, for March, 1899, shows that in all classified lines of machinery, except locomotive and stationary engines and boilers and fire engines, the foreign shipments were heavier than for the corresponding month last year.

Metal-working machinery exports for March, 1899, amounted to $638,664; for March, 1898, $451,855. For February, 1899, they have already been reported, $435,094. For the nine months ending March, 1899, since the beginning of the present fiscal year, they were $4,832,569; for the corresponding period, ending March, 1898, $3,312,960.

Electrical machinery exports were: For March, 1899, $254,092; March, 1898, $243,578; February, 1899, $134,412; nine months ending March, 1899, $2,080,739; nine months ending March, 1898, $1,517,498.

Printing presses and parts thereof: March, 1899, $127,259; March, 1898, $85,284; February, 1899, $33,264; nine months ending March, 1899, $589,251; nine months ending March, 1898, $694,030.

Pumps and pumping machinery: March, 1899, $333,006; March, 1898, $229,438; February, 1899, $199,477; nine months ending March, 1899, $1,974,007; nine months ending March, 1898, $1,507,488.

Locomotive engines: March, 1899, 30 in number, aggregating in value $254,032; March, 1898, 68, at $530,748; February, 1899, 25, at $229,503; nine months ending March, 1899, 372, at $3,432,674; nine months ending March, 1898, 337, at $2,791,318.

Stationary engines: March, 1899, 38 in number, amounting to $19,222; March, 1898, 72, at $57,022; February, 1899, 33, at $23,684; nine months ending March, 1899, 357, at $214,431; nine months ending March, 1898, 431, at $307,429.

Boilers and parts of engines: March, 1899, $81,508; March, 1898, $103,825; February, 1899, $77,104; nine months ending March, 1899, $865,497; nine months ending March, 1898, $679,484.

Sewing machines and parts hereof: March, 1899, $400,780; March, 1898, $316,463; February, 1899, $262,505; nine months ending March, 1899, $2,282,333; nine months ending March, 1898, $2,226,384.

Typewriting machines and parts thereof: March, 1899, $309,611; March, 1898, $215,915; February, 1899, $201,312; nine months ending March, 1899, $1,684,079; nine months ending March, 1898, $1,341,215.

Shoe machinery: March, 1899, $93,492; March, 1898, $77,661; February, 1899, $67,562; nine months ending March, 1899, $664,092; nine months ending March, 1898, $640,738.

CINCINNATI REPORT.

As yet there is not a sign of abatement in the machinery trade of this part of the Central West. It looks as if business would keep right along without let-up during the summer months. Foreign demand is good, but home trade is the feature. Manufacturers are obtaining a fair advance, consequent upon higher-priced materials and labor. Raw and finished materials are still in good demand, although it is true that the pig iron trade was somewhat quieter in April than in March. There is much difficulty in obtaining iron for melting. One thing that people here find to talk about and worry over is the extent of the trust mania.

The American Tool Works Company has shipped a 30-inch by 36-foot shafting lathe to St. Petersburg, Russia. The R. K. LeBlond Machine Tool Company now has 105 men working on full time, although not at night, as experience has convinced the company that night work does not pay. Its business, chiefly domestic, is double what it was a year ago. The Cincinnati Shaper Company has added to its equipment a 36-inch by 16-foot Niles planer, a 25-inch by 10-foot Bradford Mill Company lathe, and several drills. These tools will soon be supplemented with others. Beside home orders for shapers, extending as far as San Francisco, the company has contracts from Germany, Norway, and Milan, Italy.

April sales of the Cincinnati office of the Buckeye Engine Company were good. The National Cash Register Company, Dayton, O., bought an engine of 600 horsepower. The Buckeye Company's home office and works are very busy. Houston, Stanwood & Gamble find March and April to have been the best months in their history. The I. & E. Greenwald Company has filled an order for a large automatic engine for the New Richmond (Ohio) Electric Light Company, and is furnishing some very heavy gearing to water-wheel manufacturers in Ohio.

The McIlvain & Spiegel Boiler & Tank Company has orders for eight boilers for the American Oak Leather Company, and twelve for the new plant of the Fleischmann Company, at Peekskill, N. Y. The Tudor Boiler Manufacturing Company will soon place on the market a new boiler.

The Snow Steam Pump Works' agency here has contracted to furnish four pumps, having a total capacity of about 1,300,000 gallons daily, to be used at power stations on the line of an electric railway between Cincinnati and Rising Sun, Ind.

Late last month 100 gentlemen from the Manufacturers and Commercial Club paid an interesting visit to the new plant of the Bullock Electric Manufacturing Company, Norwood, Ohio.

Quotations.

NEW YORK, Monday, May 15.

Iron — American pig, tidewater delivery:—

Pennsylvania irons:	
No. 1 X foundry	$16 75 @ 17 00
No. 2 X foundry	15 75 @ 16 00
No. 2 plain	15 25 @ 15 50
Gray forge	14 75 @ 15 00
Alabama irons:	
No. 1 foundry	16 00 @ 16 50
No. 2 foundry	15 25 @ 15 75
No. 3 foundry	14 75 @ 15 25
No. 1 soft	15 75 @ 16 25
No. 2 soft	15 25 @ 15 75
Foundry forge	14 00 @ 14.50

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.50 @ 1.55c., nominally; refined, 1.60c., upward. Store prices: Common, 1.70 @ 1.75c.; refined, 1.80c., upward.

Tool Steel — Base Sizes — Standard quality, 6 @ 7c.; extra grades, 12 @ 14c.; special grades, 10c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 2.00 @ 2.10c.

Cold Rolled Steel Shafting—Base Sizes, from store, in small lots, 3.00c.

Copper—Carload lots, Lake Superior ingot, 18½c.; electrolytic, 17½ @ 17¾c.; casting copper, 17 @ 17½c.

Pig Lead—Carload lots, 4.45 @ 4.50c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 25⅞ @ 26c., f. o. b. New York.

Spelter—Prime Western, in carload lots, 6⅞ @ 7c., New York delivery.

Antimony—In cask lots and over, 10c. for Hallett's and French E. B.; 11c. for Cookson's.

Lard Oil—Prime City, ice-pressed, 42 @ 43c. for the leading brand, in wholesale lots.

Some of the Work of A. B. Landis.

The older readers of the "American Machinist" will remember that back in the early eighties one of its most valued correspondents was A. B. Landis, of Waynesboro, Pa. His communications were always rich in ideas, and were, I am sure, generally read by others with as much of profit and enjoyment as they were by myself. He has not been writing much lately; not because he has run out of ideas, but because he has had to work too hard—has gone into business, built up a shop to be destroyed by fire, and then built a better one, which he is now managing, and which I had the pleasure of visiting not long ago, and feel confident that many of the present readers of the paper will be interested in an account of. But first it will be in order to take up some of the things to be seen in another Waynesboro shop, because these things show the origin and fix the dates of many of the ideas now embodied in the products of the present Landis Tool Company and in the machine-shop practice of to-day.

The brothers Landis—A. B. and F. F.—were at one time in the business of building portable engines for farmers' use. They were both machinists, and though they worked hard to attain success, they found that the business required, to carry it on successfully, more capital than they could command; so they sold out and both engaged with the Geiser Manufacturing Company, of Waynesboro. This concern is a very large one, and seems not to be in the least troubled from lack of capital. It builds very many traction engines and threshing machines, and on the former it puts, and has for many years been putting, a class of work which is very unusual, and, in fact, so far as I know, entirely unique for engines of that kind.

PARTS OF TRACTION ENGINES FINISHED BY GRINDING.

At Fig. 1 is a view of the parts of the engine which are finished by grinding, and which include the crank-shaft and pin, the piston valve and the bushing in which it works, the cross-head pin and some other parts, the uses of which will be explained further on. Of these parts the valve and its bushing and the pins at least are hardened; or rather I should say that the pins only are hardened, for the valve and its bushing do not need to be hardened. They are cast of the white iron which is used for making malleable castings, and the annealing process is omitted, leaving them as hard as glass. The grinding is admirably done—surfaces are beautifully finished, and the fits, especially of the valve bushing into its seat and of the valve in the bushing, are close and good, and are made to gage so as to be strictly interchangeable.

THE MACHINES USED FOR GRINDING.

This grinding is done by machines built for the purpose from the designs of A. B. Landis while employed here in charge of the tool work, helped out by some that have been built by him since leaving to go into business for himself, and the valve

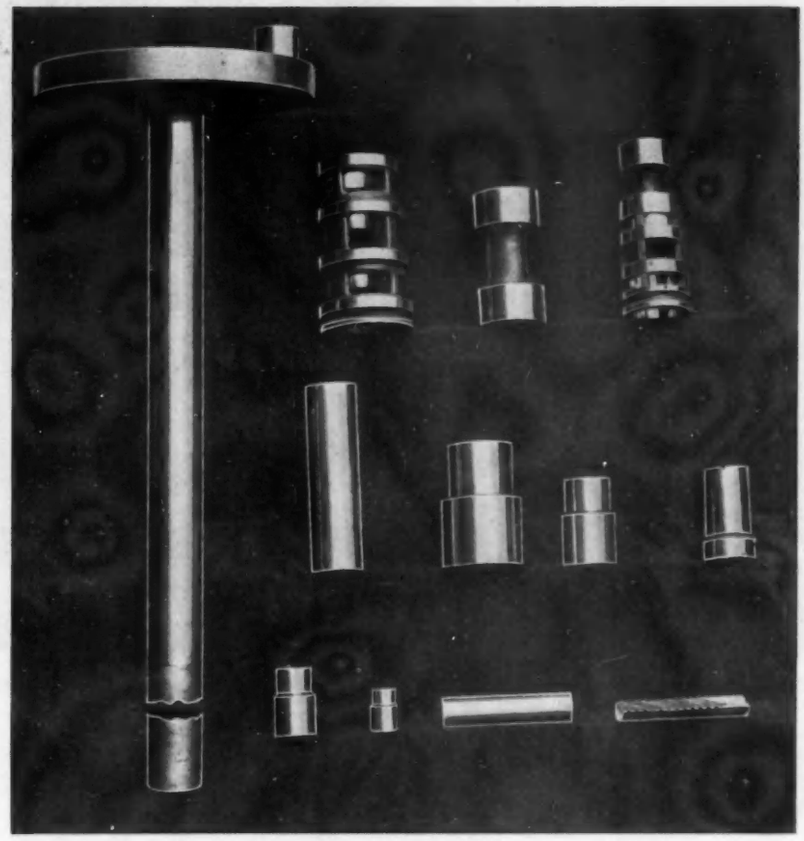


FIG. 1. PARTS OF TRACTION ENGINE, BUILT BY GEISER MANUFACTURING COMPANY, THAT ARE FINISHED BY GRINDING.

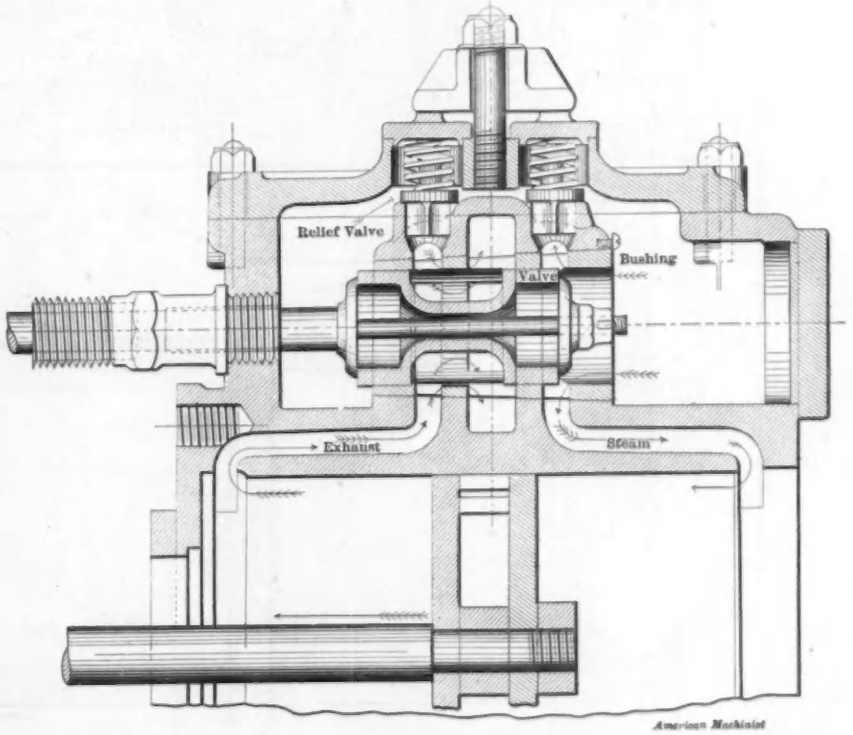


Fig. 2

SECTION THROUGH VALVE CHEST OF GEISER MANUFACTURING COMPANY'S TRACTION ENGINE. INVENTION AND DESIGN OF F. F. LANDIS, 1885.

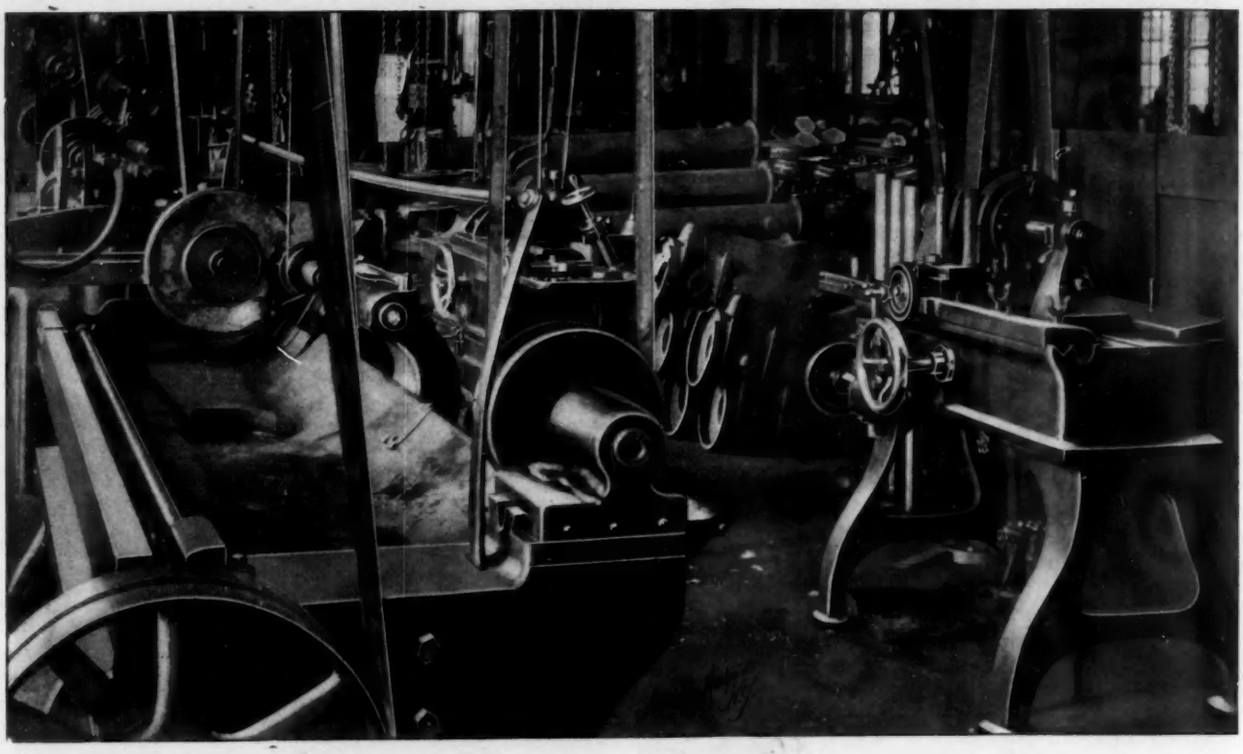


FIG. 3. GROUP OF ORIGINAL LANDIS GRINDING MACHINES, BUILT AND IN USE IN THE SHOPS OF THE GEISER MANUFACTURING COMPANY.

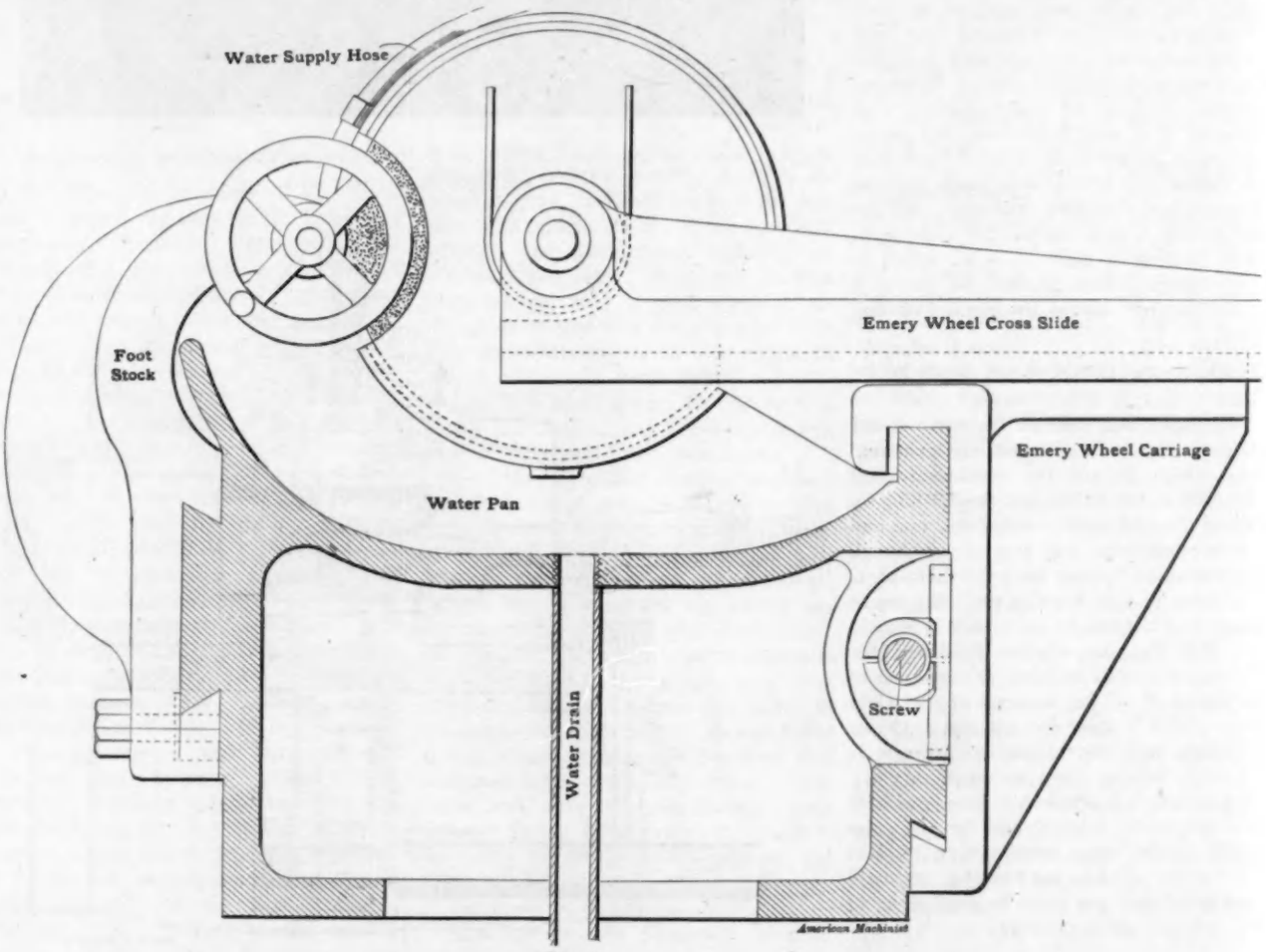


Fig. 4

CROSS SECTION SHOWING GENERAL ARRANGEMENT OF PLAIN GRINDING MACHINE BUILT AT GEISER MANUFACTURING COMPANY'S SHOPS BY A. B. LANDIS IN 1886.

itself is the design of his brother, F. F. Landis, and dates back to 1885. At Fig. 2 is a section of the valve-chest and valve showing how the steam is distributed and that the valve is perfectly balanced—a point of considerable importance in the section showing the general arrangement of the plain grinder which was built in 1886, and which shows the provision made for the very free use of water without permitting it to get into the working portions of the machine. In other respects it it is not according to present-day ideas; but the machine is in constant use and doing good work.

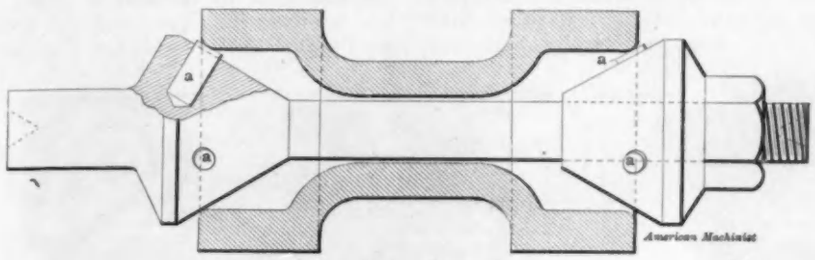


Fig. 5

ARBOR FOR GRINDING PISTON VALVE.

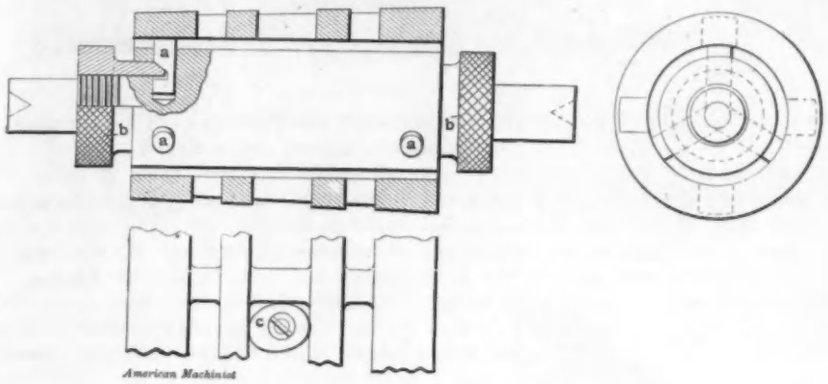


FIG. 6. EXPANDING ARBOR FOR GRINDING PISTON VALVE BUSHINGS.

saving of wear and in enabling the engine to be readily reversed, as it must be, in order to "handle well" in service.

FREE USE OF WATER IN GRINDING.

Although the grinding machines built for this work were constructed about 1886 and 1887, it is a significant fact that they are fully up to the most modern standard in regard to the liberal use of water during the grinding operation; and the machines, as I saw them in use in the shops of the Geiser Manufacturing Company, show that the provision for flooding the wheel with water to carry off heat and dust was not an after-thought applied to the machines after they had been in use for a time, but is a component part of their original design, the importance of which was fully recognized and provision made for it upon the drawing board. At Fig. 3 is shown a group of these machines in use in the shop of the Geiser Manufacturing Company, the large plain grinder being at the left, a special machine for grinding the interior of the valve bushings at the right and the first Landis universal machine in the central background. In all these it is obvious that provision was made in the original design for an abundant flooding with water, and that the designer fully recognized at that time the importance of this feature in doing good work rapidly. At Fig. 4 is a cross-

SOME FIXTURES USED IN GRINDING PARTS.

Some of the fixtures designed and made at the same time by Mr. Landis, and still in use in these shops, in connection with the grinding machines, ought to be interesting, and in Figs. 5, 6, 7 and 11 four of them are shown. The first of these, Fig. 5, is for grinding the outside of the valve, and consists simply of an arbor having a fixed and an adjustable cone, these cones being each provided with three pins set in as indicated, so that at each end of the valve it is supported at three points, and is thus bound to find a secure bearing upon which it cannot shift, notwithstanding that the surfaces by which it is held are not trued, but are just as they come from the foundry. The ends of the pins *a* are ground true after being put in place.

The bushing for the valve must be ground both inside and out, and it is first ground externally upon the arbor shown at Fig. 6. Here the same principle of supporting the work at three points at each end is employed, but is differently worked out, as called for by the different form of the work. As no cutting whatever can be done on these pieces owing to the hardness of the metal of which they are made, great pains are taken to cast them as accurately as possible, so as to reduce the necessary amount of grinding to the minimum. To this end the inner surface is formed by a core made of green sand,

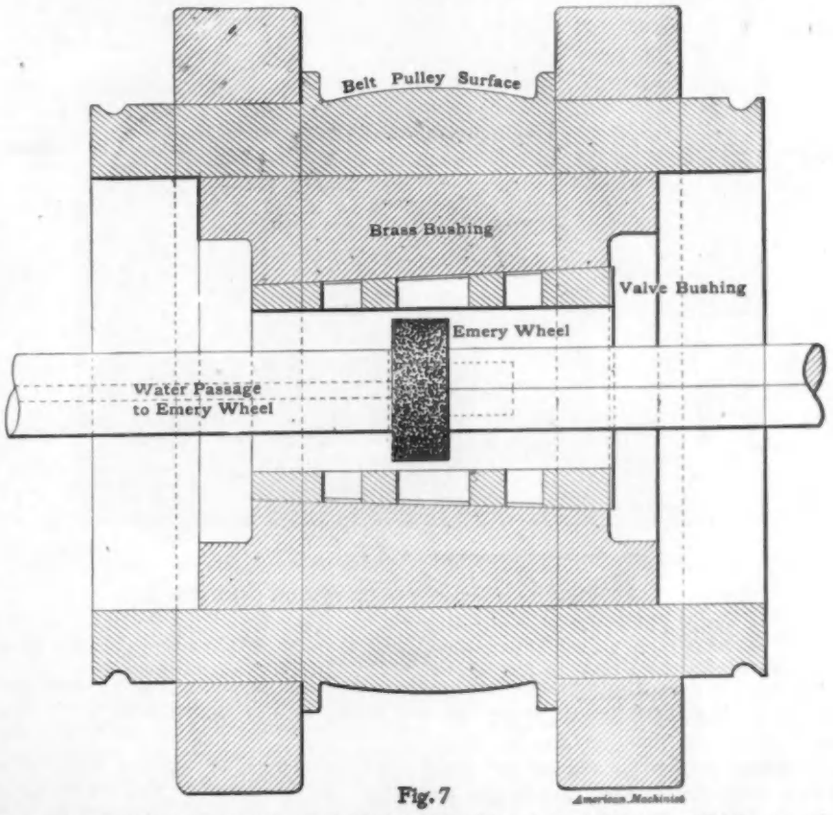


Fig. 7

SECTION THROUGH CHUCK USED IN GRINDING VALVE BUSHINGS. GEISER MANUFACTURING COMPANY.

which core is made in an accurately-bored box, from which it is forced by a suitable plunger, and immediately laid in the mold. The arbor, Fig. 6, is made to center and hold the bushing by this interior surface. Near each end of the enlarged central portion of the arbor three radial holes are drilled, and in each of the six holes thus made a hardened steel pin is placed. At *a* a side view of one of these pins is shown, and it is there seen that a notch is formed in the side of the pins; this notch being beveled on one side to engage the beveled edge of the nut *b*. This nut, when turned, moves the pins outward, and as they are previously ground true, they of course accurately center the bushing by its interior surface. Both ends of the arbor are alike. It is of course important to avoid springing the bushing, and to this end the nuts are turned up only until the pins take a fair bearing; and the driving is done by the driver *c*, which is placed upon a stud screwed into the body of the arbor and turned until it bears upon the three points as shown, in which position it prevents endwise displacement, and at the same time, by bearing against one of the bridges of the bushing, does the driving. It is removed by the use of a screw-driver before the bushing can be removed from the arbor. By this ingenious and interesting arrangement a casting on which no work has yet been done is centered as true as it is possible to do it, and held securely enough for the operation to be performed without danger of springing it, and it is done quickly and without the necessity for exercising extreme care or skill.

The next operation is to grind the bushing internally for the reception of the valve. This is done in the special machine seen at the right of Fig. 3, and the arrangement for holding the bushing is shown in Fig. 7. The brass bushing indicated in this figure is fitted to a sleeve which runs in bearings at either side as shown, and has a belt surface at the center by which it is driven. This brass bushing is carefully bored out and ground to the correct taper for the valve bushings, and they are held by being lightly tapped into place with a hammer, and removed in the same way. Brass is chosen for the material of the bushing to avoid rust, water being plentifully used in this operation as in the others.

It will be noticed that the grinding arbor is supported from both sides for this operation, instead of being overhung as usual. Provision is made for the quick removal of the arbor when the work is to be changed, and the means of securing an abundant flow of water to the wheel are plainly indicated. It is to be understood, of course, that this fixture does not turn at any great speed, and the groove turned on the outside of the sleeve near each end is sufficient to insure that the water, which is mixed with the material removed by the wheel, will drop off at that point and not work its way into the bearings.

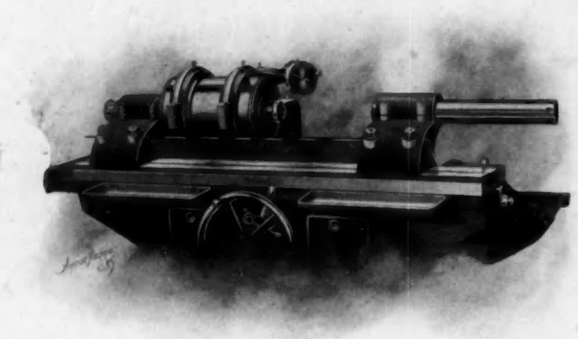


FIG. 8. TOP PORTION OF GRINDING MACHINE WITH ATTACHMENT FOR INTERNAL GRINDING.

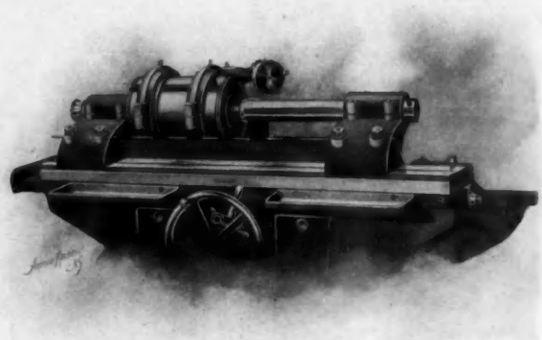


FIG. 9. GRINDING MACHINE WITH ATTACHMENT FOR INTERNAL GRINDING. LANDIS TOOL COMPANY.

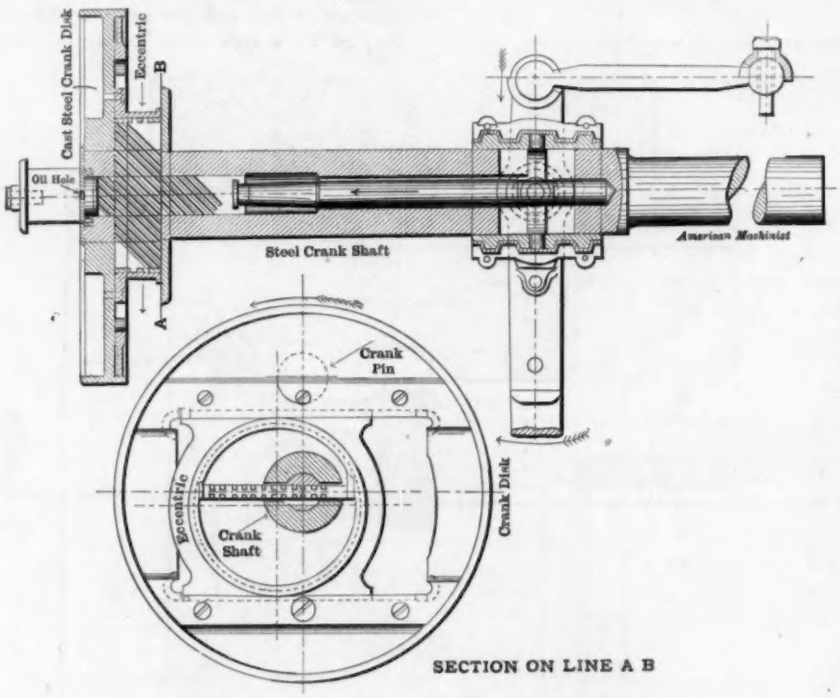


Fig. 10

VARIABLE CUT-OFF AND REVERSING MECHANISM OF GEISER MANUFACTURING COMPANY'S TRACTION ENGINE. INVENTION AND DESIGN OF A. B. LANDIS, 1884-5.

AN ATTACHMENT FOR INTERNAL GRINDING.

The success attained with this machine has led the Landis Tool Company to supply, when it is wanted, an attachment to their regular universal or plain grinding machine which embodies the same principles, and is shown at Figs. 8 and 9. The first of these shows the attachment in place on the machine with the work inserted, and with the end of the grinding arbor and the wheel showing. This grinding arbor is inclosed in a sleeve, which is cut away, as shown, for the wheel to pro-

ject from it, and threaded for connecting the end of the supporting bar seen at the right, which, when disconnected and slipped back as here shown, permits the work to be put in place or removed. Fig. 9 shows it in position for work, and a glance is sufficient to show that the wheel is uncommonly well supported and that there can be very little bother from its springing away from the work. Yet the grinding arbor itself can be as small as is desirable for the high speed at which it must run. It is supported in adjustable bronze bearings at each end, and instead of the outer one being overhung, as usual, it is supported at the middle of what is practically a rigid bar that can be nearly the size of the hole, and is securely clamped in a substantial block at both ends. In this fixture there is the same provision for a liberal supply of water to the wheel during the grinding, and means are provided for taking care of the water after it has done its work.

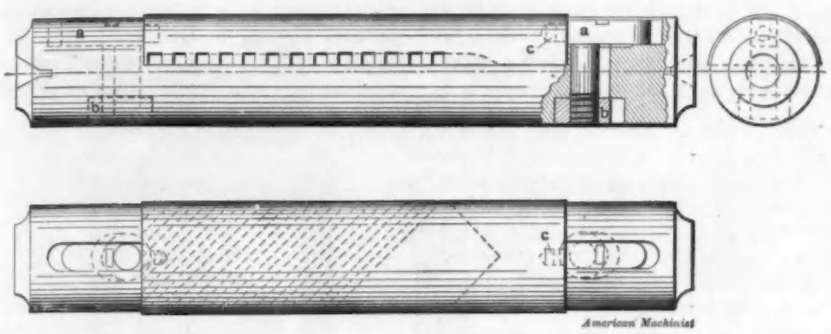


FIG. 11. ARBOR FOR GRINDING HALF-ROUND GROOVED BARS.

REVERSING MECHANISM FOR TRACTION ENGINES.

Although A. B. Landis was supposed to have charge of the tool work at the Geiser Manufacturing Company's place, he occasionally overstepped the bounds of that work, as is shown by the fact that the unique method of reversing their traction engine which is still in use by them was invented and designed by him and patented in 1884. Longitudinal and cross-sections of the mechanism are shown in Fig. 10. On the back side of the crank-disk V-slides are provided upon which the eccentric is arranged to shift, its movement being effected by means of the peculiar notched pieces, one of which is shown at the lower right-hand corner of Fig. 1. Two of these are placed in the crank-shaft side by side, so that the notches engage with similar notches formed on both sides of a flat piece which lies between them; and as the notches are all at an angle of 45 degrees with the lines of movement, it follows that when the two semi-cylindrical pieces are moved lengthwise within the crank-shank, the flat piece lying between them must move radially; and as this is connected to the eccentric, the latter is shifted to any desired position for change of cut-off or for reversal. These pieces may, in fact, be regarded as helical gears straightened out into racks. The sliding movement is effected by means of a lever which moves the sliding collar shown, which collar is connected to a rod that lies in the hole bored for it through the center of the crank-shaft, which is of steel.

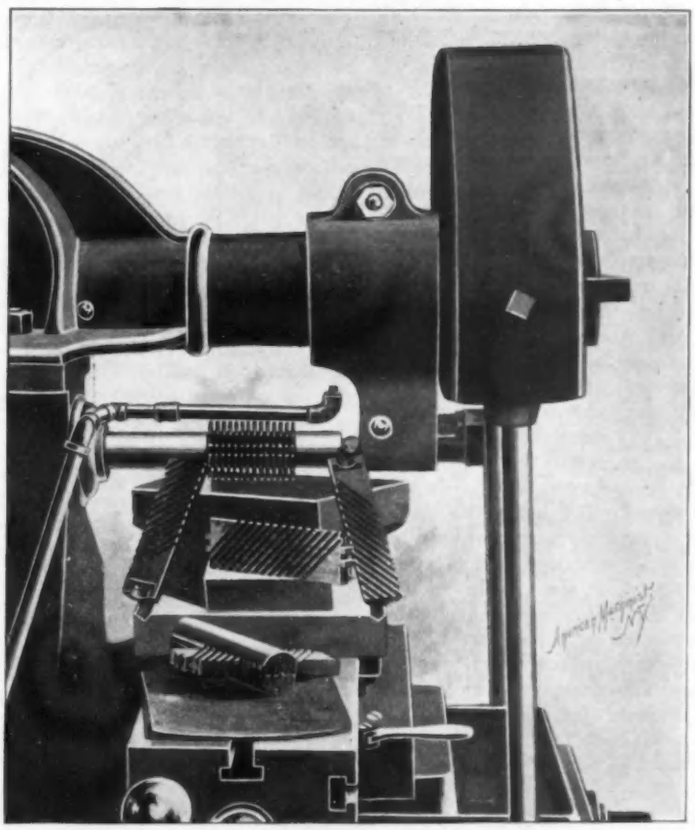


FIG. 12. MILLING GROOVED BARS FOR REVERSING MECHANISM OF GEISER MANUFACTURING COMPANY'S TRACTION ENGINE.

SOME SPECIAL FIXTURES FOR MAKING THE REVERSING MECHANISM.

It will readily be surmised that the manufacturing operations involved in the production of this mechanism would seem rather formidable in most agricultural engine shops, and indeed the cost of such work would be prohibitive if it were not done in the best possible manner and by the use of special tools throughout. These tools, as I saw them at work, are admirable examples of such things, and I only wish it were possible to show all of them, but must content myself with a few of the more interesting ones. At Fig. 11 is the grinding arbor on which the cylindrical surfaces of the two notched pieces are ground in the universal grinder. Holes are drilled in each end of the piece by a template, and these locate the work. At each end of the arbor is a sliding piece with a pin formed on it, these pins engaging the work as shown. They are then drawn down by the nuts *b*, using a forked screw-driver. The arbor, which is of steel, hardened and ground, is 1-32 inch smaller in diameter than the circle to which the pieces are to be ground, and therefore a solid caliper is provided for the operator, which caliper is 1-64 inch smaller than the full diameter of the work would be, and this is passed over the arbor and work. Although the arbor is so much cut away, it will be noticed that at each end there is a cylindrical section which will always show whether the arbor remains true of not.

At Fig. 12 is shown something of the operation of milling the grooves in these pieces on one of the older forms of the universal milling machine, which is of course not necessary for this work, nor the best machine for it; but was utilized

because it was on hand and had not enough to keep it otherwise fully employed. The cutters are ⅛ inch + .0005 and the washers ⅛ inch — .0005 inch, so that the grooves have .001 inch clearance. The weight was placed on the end of the overhanging arm as an exemplification of the anvil principle, as on this cut it was found that chattering took place, which the weight completely cured. Its weight is actually borne by the floor, and it simply touches the arm, which is sufficient. It was found to be important also to keep the cutters absolutely flooded with lard oil, as otherwise the chips were a source of much trouble.

DEEP HOLE DRILLING—ORIGIN OF PRESENT PRACTICE.

It was on this job of crank-shaft boring that the experience was obtained upon which was based Mr. Landis' article published in the "American Machinist" of March 27, 1886, in which article he showed how such drilling of deep holes should be done, and gave drawings of the tools to be used on the job. All of the hollow spindles used in machine tool construction at the present time, and also many gun barrels, are bored with tools and by the method shown in that article, which involves forced lubrication carried to the end of the drill and out through a separate return channel for carrying away the chips; this method having now passed into the regular and recognized practice of our American machine shops, where it is no doubt used by many who have forgotten and by others who never knew its origin. And it has not been materially improved upon, all the features of the most advanced present-day practice in such work being shown in the article referred to. It is more than probable also that this has suggested the present practice in the use of twist drills with tubes for lubricant, for the one is the complement and the natural sequence of the other.

As previously intimated, there are many other things to be seen in the shops of the Geiser Manufacturing Company which would be interesting if they could be presented, although some of them have been shown in articles contributed by Mr. Landis. Limitations of space and other considerations make it impossible to present more of them at this time, however. But it is due to Mr. Landis to say that very few shops show more plainly the impress of one man's good work and advanced ideas. I purpose giving, in another article, an account of the shops of the Landis Tool Company, where these ideas have been further developed. F. J. M.

We have received from the house of H. Bollinckx, of Brussels, a wall map of Belgium, the cities and towns of that country in which Bollinckx engines are running being indicated by yellow dots, the number of those dots indicating the number of engines in that locality. This is an idea that might be worth imitating.

Machine Tools—IV.

BY J. RICHARDS.

MANDREL PRESSES.

Figs. 26 and 27 represent a mandrel driving machine which embodies an idea or scheme that deserves especial attention, because it is to be doubted if among the various machines made since Bodmer's there has been one of greater merit, if the self-acting part is omitted—that is, all parts above the shaft *A*—and a hand-wheel is placed in the driving spindle at *B*.

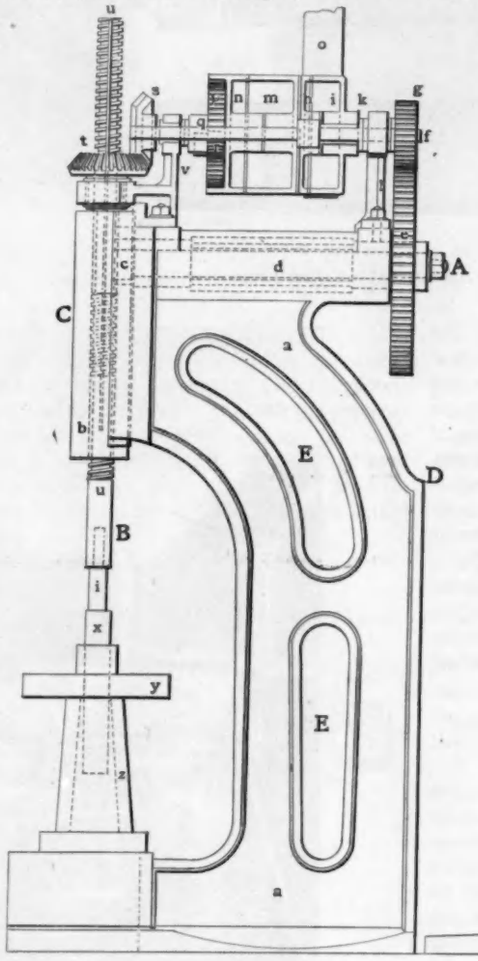


Fig. 26

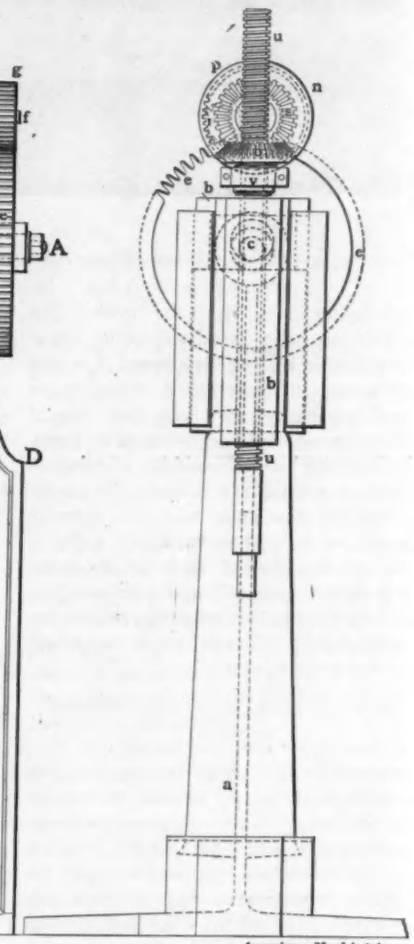


Fig. 27

MANDREL DRIVING MACHINE.

The writer, in 1885, to test the performance of a machine of this kind, designed and had made at Manchester, England, a mandrel press, shown in Fig. 28. The stroke was about 3-16 inch and the speed 120 strokes a minute. The elasticity or flexure in average working was 1-16, so the extreme feed or movement of the mandrels was ¼ inch per second, but could be as much less as required, or as the hand-wheel was turned. It is hard to realize without experiment the completeness of the operation. It is the same as though the operator was pushing the mandrels in or out by hand. He could "feel" the whole operation, which could be fast or slow, ⅛ inch or 1-32 inch at each stroke. There was also the peculiarity of the force being graduated to the work; the less the movement the greater the force. The machines are simple, cheap and durable; why they are not in use is a problem not easy to answer.

A hydraulic mandrel driving machine is a complicated and expensive one in comparison, and if rigid is dangerous, because it gives no sign of the force employed except by a pressure gage, which the men are apt to ignore. I once imported a very complete one from England and found it useful in the hands of skilled men, but not as an implement for general use in the shop. It proved of much value in drifting key-ways and the like.

Referring again to the Bodmer machine, it will be seen that the power feeding devices that make up a principal part of the machine are ingeniously devised, and, as before said, are useless; not only useless, but an impediment to successful working. It is an example of that mistaken zeal that strives to make all kinds of machines automatic or self-acting. Any machine that demands the constant presence of an attendant should always leave him some function to perform, otherwise his attention is distracted from the work and "something happens."

The framing of Bodmer's machine is,

in the side view, grotesque and has value as an example to be avoided. The kink at *D* and the vertical face at the back indicate that a second machine of the same or some other kind was to be bolted to this face. The tapering slots *E* are harder to explain.

It was the intention to have extended this notice of Bodmer's machines to various other examples, but his patents are out of print, and the examples already given give a fair representation of the best practice of his time. Drawings of his gages, which were of the plug and ring type, do not appear, but from the descriptions they were substantially the same as those afterwards made by Whitworth.

FIG. 28. MANDREL DRIVING MACHINE.

Bodmer employed metrical dimensions, had shrink scales for the pattern makers, also made his tooth gearing with diametral pitch, afterwards called the "Manchester pitch." He claimed, and logically, too, that the principal fact about a gear wheel was its diameter, and not the space between centers of the teeth, which produced a fractional diameter, a truth that American machine tool makers do not need instruction about at this day.

S. H. Roper's Steam Bicycle.

BY R. I. CLEGG.

From time to time, in the columns of the "American Machinist," as well as other magazines in which the progress of the motocycle has been chronicled, one meets with mention of S. H. Roper and his labors. So far as I am aware, no description, other than such as appear in the newspaper press, couched in general terms, has appeared in print, giving details of any of his machines. The following data will be new to many, and if they prove interesting to my fellow-students of the "American Machinist" I shall feel well repaid for the labor of compilation.

The late Sylvester Hayward Roper, of Roxbury, Mass., became interested in automobile investigations away back in the fifties; and he thus early realized the bitterness of the storm that awaits the pioneer who interferes with the established rules of the road.

So far as a suitable power was concerned, Mr. Roper's hopes were centered upon steam, and his long experience simply served to deepen this conviction. Several vehicles so equipped were built by him before 1870, but there was so much opposition to his right to use the public streets that he finally desisted, as far as actual manufacture was concerned, and retained one machine solely for his own personal use and experiment. Along in 1869 or 1870 he constructed a successful steam velocipede, similar to a modern bicycle, with, of course, the differences incidental to the then state of the art.

For instance, the wheels were fitted with hardened steel cone bearings and steel tires. In the frame were telescopic tubes with enclosed spiral springs—a neat arrangement that I have seen adopted with good effect even on a pneumatic-tired wheel as recently as last year.

This velocipede was in use for some twelve years when Mr. Roper built a four-wheeled carriage—a double-seated sulky to carry two persons. The cylinders of the engine were located in the smoke-stack, and all but the lower part of boiler was concealed in the body of the vehicle. The sulky was afterwards sold to a Boston merchant who intended to apply an oil-fuel system in place of the coal grate already in use. Business cares prevented any great progress in this line, and the machine next turned up in New York City as the nucleus of a proposed autocar company, and later still, I understand, the machine went South, where I have been unable to trace it further.

At seventy-three years of age Mr. Roper took up the steam bicycle once more. The evolution of the racing speed merchant demanded a fleet pacing equipment, and the mechanical problems incidental to the construction of a capable pacing machine were best solved by the tests of actual working conditions. In his last machine he proposed to determine the power to overcome wind pressure, the problem of the most suitable fuel, etc.

He took a Columbia bicycle, removed the cranks, chain, hanger and rear wheel bearing, and in the diamond frame attached his outfit—boiler and engine—as an integral part of the structure. Figs. 1 and 2 show the reconstructed bicycle; and Fig. 1 includes the inventor, who holds the wheel in position. In the other view —Fig. 2—the bicycle is seen self-supported by the rod hinged to boiler. Figs. 3 and 4 give some dimensions and indicate location of details likely to be of service in the study of the half-tones.

The engine is a single cylinder, 1¾ inches diameter by 4-inch stroke. A D-slide valve is driven by an overhanging pin outside the engine crank. From the other end of crank shaft is driven the feed

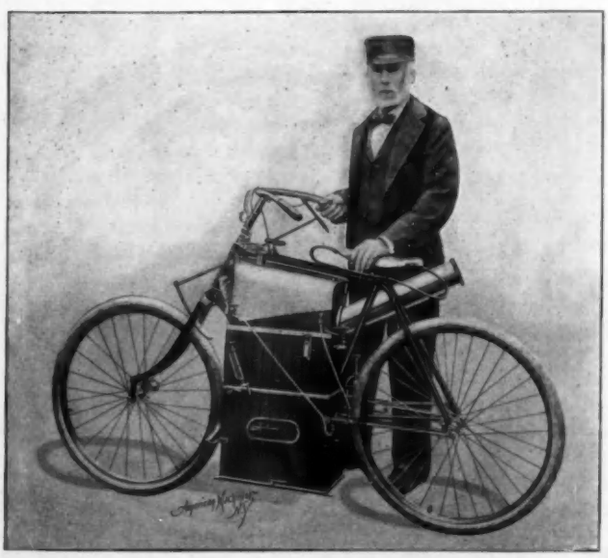


FIG. 1. S. H. ROPER AND HIS STEAM BICYCLE.

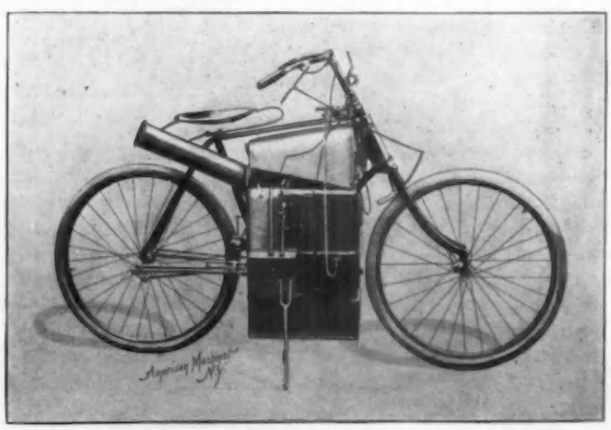


FIG. 2. S. H. ROPER'S STEAM BICYCLE.

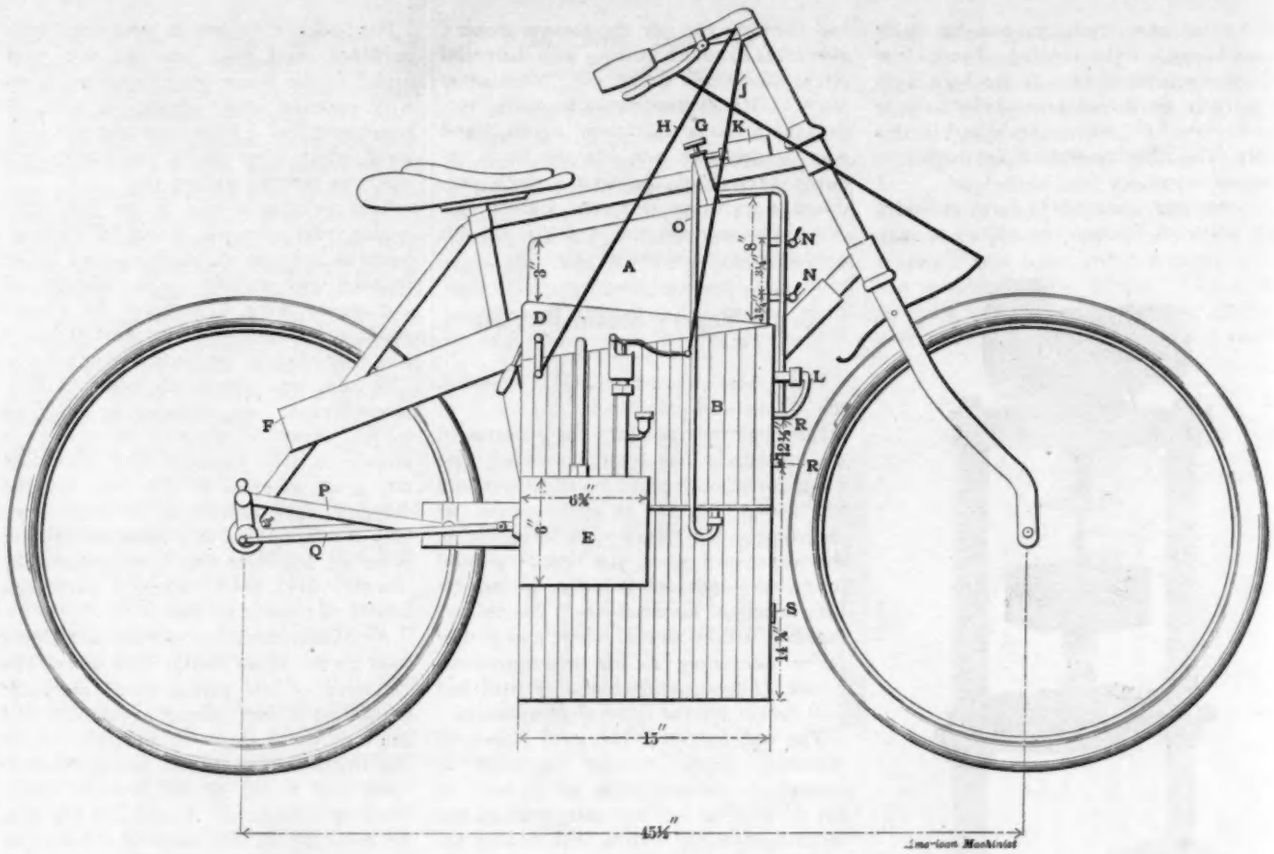


Fig. 3

RIGHT SIDE OF ROPER'S STEAM BICYCLE.

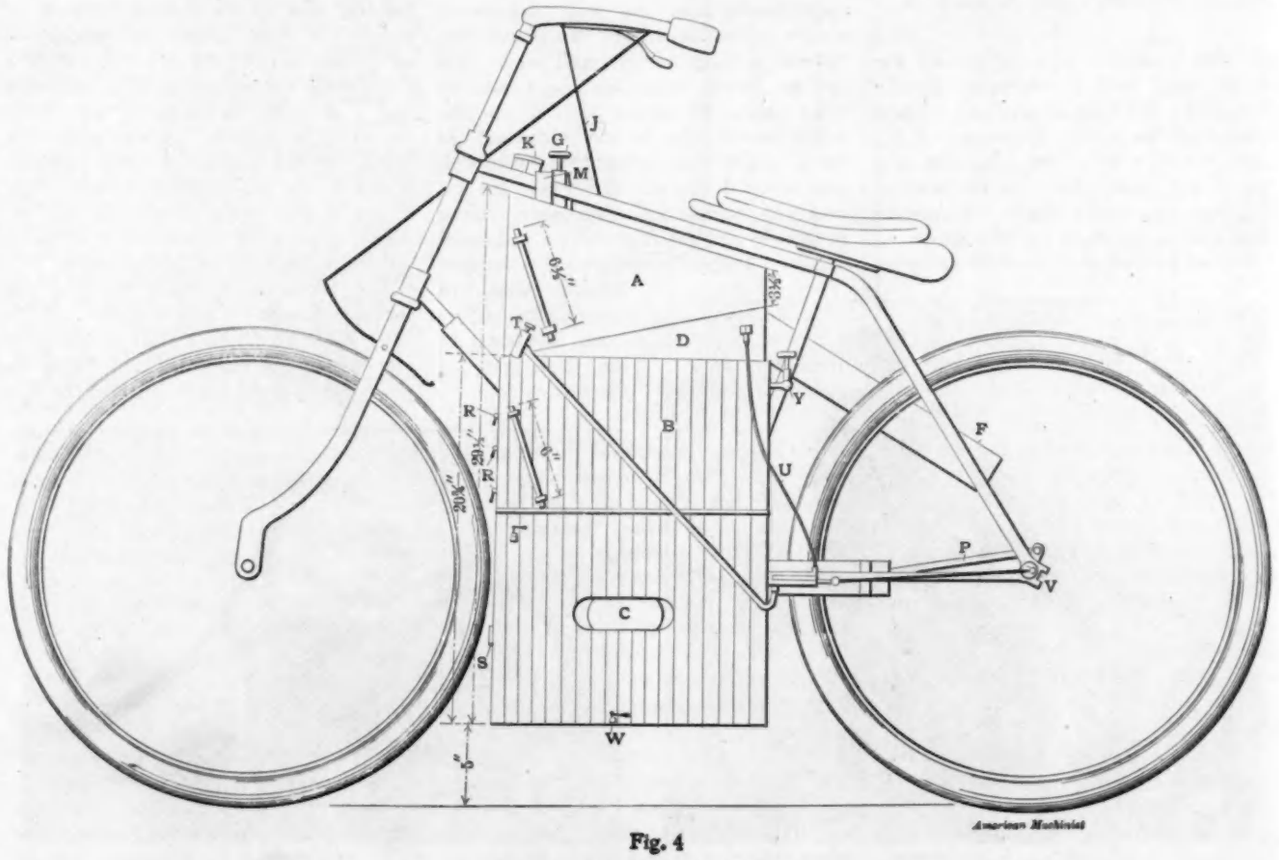


Fig. 4

LEFT SIDE OF ROPER'S STEAM BICYCLE.

pump. The pump has a stroke of 1 inch, and the plunger is ¼ inch diameter. The feed water is contained in the tank, immediately under the rider, and absorbs heat coming from the smoke-stack and boiler. Before entering the boiler the feed water passes through a coil heater in the smoke-stack. Inclined glass water columns to tank and boiler allow the rider to keep track of the supply. A valve on the suction pipe permits the supply to be nicely regulated for ordinary conditions of travel, and a hand pump seen near the handle bars enables an increased amount to be provided at pleasure. Part of the products of combustion passes around the engine cylinder to the stack, which also receives the exhaust from the engine. Two cords control both boiler and engine; a damper in smoke-stack, as well as the throttle valve, being so connected with the handle bars. On each side are the foot-rests, at the forward end of the firebox.

The exhaust from stack was entirely invisible so far as steam was concerned; a slight noise was perceptible, but not to any disagreeable extent. Opinions may differ, of course, but to my view this approaches the ideal gearing for chainless wheels.

Boiler is rectangular, 8 inches deep, 20¼ inches high, 15½ inches long, containing eighty-four steel tubes. Tubes are 10½ inches long by 9-16 diameter. I am unable to give exact thickness of tubes; they are very thin; probably, .02 inch. A space of ½ inch is allotted to the water jacket around the firebox. From base of grate to base of flues is 10 inches. The boiler is encased in asbestos and mahogany.

Franklin coal was used for fuel, and once charged the tiny grate was ample for a seven-mile trip. Mr. Roper has gone several times from his home in Roxbury to the Yacht Club, in South Boston (City Point), cleaned the fire and replaced the same coal, got up steam and returned home—three and a half miles each way.

About 160 pounds of steam was carried on level roads. For hills this pressure would be increased to 225 pounds. The boiler had been tested to 450 pounds. Total weight of machine loaded ready to start was 165 pounds.

It will be remembered that Mr. Roper died suddenly at the Charles River Track, Boston, at the close of a test of the bicycle against the Butler Brothers' tandem. He had then made three consecutive thirds (⅓) of a mile in 42, 39 and 37 seconds, respectively. The cause of Mr. Roper's death was sclerosis of the arteries, from which he had suffered for some two years, the malady undoubtedly being greatly intensified by the excitement attendant upon the remarkable speed developed at the exhibition.

Mr. Roper actually died in the saddle, as he always hoped he would. He started to reduce the time, as he knew the machine could do better if he could only stand the strain and control it. Death came before he had made more than half the round. Notwithstanding the showing already mentioned the inventor did not consider the bicycle the finished product he desired, and was preparing plans to try petroleum fuel, etc.

In Figs. 3 and 4 identical parts are designated by the same letter. *A* is the water tank and *B* the boiler, with fire-door *C*. A space *D* forms the smoke dome, to which is attached the smoke-stack *F*. The smoke-stack can be rotated, in a seat in *D*, so that it may be turned to an inclination upwards, when bicycle is at rest, to obtain increased draft (*vide* Figs. 1 and 2). *E* is the casing around engine. Into the upper part of *E* are two ⅜-inch pipes, steam and exhaust; the one enters the top of boiler, and is provided with oil cup and throttle valve; the other is turned into the smoke dome *D*. A hand pump *G* is located on top of water tank to replenish boiler through pipe *O* when preparing for a trip. The damper in *D* is controlled by the cord *H* running to handle bars; a similar cord *J* is connected with throttle in steam pipe. On top of bicycle frame is the steam gage *K*, which is coupled to boiler at *L*. The water tank is filled through a tube at *M*. *N N* are gage cocks in tank.

P and *Q* are connecting rods of engine and slide valve, and at *R R R* are the boiler gage cocks. On front of boiler are the foot-rests *S*. The water supply is regulated by the suction valve *T* (in lower part of water tank, Fig. 4). The valve *T* is piped to the pump, which is driven from rear wheel at *V*, and water supply passes thence to boiler through pipe *U* and a feed-water coil in *D*. A blow-off valve *W* is inserted into water leg of boiler.

I would acknowledge my indebtedness to Mr. Charles F. Roper and Dr. John S. Flagg. The former has very kindly permitted a description of the bicycle, designed by his father, to be given to the readers of the "American Machinist"; the latter, an old friend of Mr. Roper, took the only photographs that are extant, and which are here reproduced.

Providence, R. I.

Windmills and Compressed Air.

BY FRANK RICHARDS.

The following letter from Minnesota explains itself, and as there are many others who are thinking along the same lines it may be well to look into the subject a little. The writer says: "I own and and operate a small machine shop without power, but I need power at times very much. Any power that would take, say, thirty minutes, or even twenty minutes, to start would be valueless, as my work is very intermittent. I have tried to get city water power and electric power, but have failed to get either without an immense tax, which I can't afford. Wind is very plenty here, but entirely unreliable to drive direct. So my plan is to erect an 8-foot pumping mill of simplest form and attach a small air pump to the lower end of the pump rod and pump air directly into a tank or reservoir made like a steam boiler, but without flues or dome, and strong enough to hold from 250 to 300 pounds pressure. I would, of course, have pressure gage and safety valve, and draw at leisure into a one horse-power steam engine. Is the scheme practical, or would the varying pressure as the tank was becoming exhausted interfere with the speed of the engine more than the governor would take care of, or would the sudden expansion of the air into the cylinder cool it so as to intertere with the smooth running of the same? How large a tank would be required at 300 pounds when starting to run a one horse-power engine, say, five hours, without becoming exhausted below 50 pounds? I only want to run on an average two hours per day, and the wind blows here more than an average of eight hours per day, with Sundays thrown in."

Now, it is the most natural thing in the world for a mechanic to be thinking out such a scheme as this. It is really lamentable to know that so much good wind is running to waste when it might instead be doing useful work. There are, however, many difficulties in the way, and as a general thing it seems to be true that wind power is not more used simply because it costs more than it is worth.

The writer whose letter is here reproduced proposes to use an 8-foot windmill. I have a list of windmill capacities for pumping water, as published by a leading windmill builder. The smallest diameter in the table is 8 feet 6 inches, and the quantity of water raised per minute is given for different hights from 10 to 75 feet. For the larger wheels higher lifts are of course given in the table. Taking the water delivered per minute and the hight to which it is lifted, it is a simple matter to obtain the foot-pounds per minute of work done, and this divided by 33,000 gives us the horse-power of the wheel. For the 8-foot 6-inch wheel, the water delivered in gallons per minute to the different hights is as follows: 10 feet, 12.49 gals.; 15 feet, 6.37; 25 feet, 4.07; 50 feet, 3.12; 75 feet, 2.29. Taking the weight of a gallon as 8 pounds, the foot-pounds per minute at the 10-foot lift are $12.49 \times 8 \times 10 = 999$. The foot-pounds for the other lifts are, respectively, 764, 814, 1,248 and 1,374, and the mean of the five is 1039.8, which divided by 33,000 gives us .0315 as the horse-power of the wheel, and this of course only when the wheel is working. If the wheel runs eight hours per day we have $.0315 \times 8 = .252$ horse-power hour, so that four days work of the wheel would be required to produce 1 horse-power hour of work *at the wheel*. As it is well understood that

under any of the ordinary conditions of using compressed air, not one half of the power employed at the compression end of the system would be realized in work at the motor end, it is evident that our friend's 8-foot wheel would have to run more than a week, including Sunday, to give him 1 horse-power for one hour in his little shop.

It is quite evident that it is not worth while to go in detail into a computation of the entire scheme of using compressed air in this case, with the capacity of the reservoir, the size and arrangement and operation of the motor, etc., as the scheme as a whole, besides affording too little power, would be costly, complicated and impracticable. But something further may be said in a more general way as to the use of the windmill for air compression, as it is often suggested, and many are even now thinking about it, although little is being done, and, it may as well be added, little is likely to be done. For anything like actual work, and beyond the region of the boy and the toy, larger wheels must of course be thought of. A 30-foot wheel in the table above referred to shows about 3 horse-power when running, or 1 horse-power for every minute, all the year round. A 100-foot wheel would probably be good for 20 horse-power of continuous running; but it would cost as much as several 20 horse-power engines, and its maintenance also would perhaps be as costly as fuel, so that there is little in it under any conditions.

The pumping of water seems to be the work for which the windmill is better adapted than for any other, and this for various reasons. Water is pumped usually into a tank or reservoir where the water level varies but slightly, in comparison with the total lift, so that the work to be done is practically constant. The work of pumping is not only constant as a whole, but is uniform in detail. The pressure against the pump piston is the same at every part of the stroke, and the work per stroke varies but slightly whether the reservoir is full or nearly empty. With air compression this is all different. The pressure is constantly varying, from nothing at one end of the stroke to the delivery pressure at the other end of the stroke; and the delivery pressure, and also the mean effective pressure per stroke, must constantly vary with the pressure in the storage reservoir. In the scheme of our correspondent, it is proposed to allow the pressure in the reservoir to fluctuate between 300 pounds and 50 pounds. At the former pressure the work of the compressor, and of the windmill, in compressing and delivering the air into the reservoir, would be three times as great as when compressing to the latter pressure, and for the pressures between these the work would be constantly varying with the pressure. If the compressing apparatus, therefore, was geared to the windmill in contemplation of being effective at the highest pressure required, it must be wasteful of power and unsatisfactory at the lower pressures, and *vice versa*. For a satisfactory and economical air-compressing arrangement under the fluctuating conditions assumed, much is not yet invented.

It is usually proposed to employ windmills where the land is flat, and where it is customary to build tanks and set them upon some artificial supports to get the necessary head. This building of tanks and their supports is a costly element of the service. Where there is a suitable elevation of land the cost of the tank is then small, and in that case it is possible to use a windmill for pumping and a water motor for developing the power with results more satisfactory than can be obtained by the use of compressed air. The windmill then has its own kind of work and can work at its best, and the water motor at the other end should also do well with little fuss. A piston and dead-pull motor or water engine should show a high efficiency, but as it costs more than any of the various jet-propelled water wheels the latter are allowed to spout away the water which has been procured often at high cost. I know, of course, the astonishing efficiency of the Pelton water wheel, and of others of its class and of other classes, but I also have friends who have whirligig contrivances for driving sewing machines and such work, and I know that *some* of the water slips by without giving things much of a shove. Water that goes into a cylinder of a water engine simply has to push the piston along before it can get out, and it is practically all accounted for, as there is no loss by clearance as with air or gas or steam engines.

The Objects of Combinations.

If merely legitimate trade development were the purpose of these huge combinations it would seem to be a necessary feature of them that their organizers and managers should be chiefly, if not solely, men skilled in the particular trade affected—men who had been trained and brought up in the business. It would seem, moreover, equally natural and logical to expect that such organizations, if intended simply for the development of trade according to modern ideas on strictly economical lines, should be perfected in their offices and factories and not in the resorts of speculators and stock manipulators. It would also seem reasonable to suppose that if they were got up simply to enhance the value of the individual properties included in the combination, the lucky owners of these properties would be glad to remain in quiet possession of their plant and increasingly productive business, and that the last thing they would think of would be to surrender a part of their prospective earnings to outsiders and the public generally.

The promoter of the combines, trusts and syndicates of recent growth is almost invariably an expert Wall street operator and nothing more, utterly ignorant of the practical operations of any trade save that of stock manipulation, and with as little consideration for the future of the industry which he undertakes to organize as for the interests of the consumers of its products. It is primarily, if not exclusively, his business to enrich himself and those associated with him at the public expense.

To find the way to turn out a better product of industry for less money than before is quite outside of the range of the gentlemen who are chiefly responsible for the recent astounding increase of vast agglomerations of manufacturing enterprises. It would appear to be obvious that if the experience and intelligence of practical men dominated these combinations there would be a very close appraisal of the value of their constituent parts, and a considerable amount of care to provide for every dollar of stock a solid basis of some description of valuable property. That would be the natural rule to be followed by any set of men engaged in perfecting an organization in which they expected to remain, and of the consequences of whose success or failure they alone would be sensible. But the preposterous over-capitalization of most of these enterprises reveals the kind of intelligence that presides over their formation, and the quarter from which profit is expected to come to the organizers. It may be difficult to say at what precise point the deliberate exaggeration of the value of any commodity assumes the character of a fraud, but it is not at all difficult to predict that the man who holds a mass of securities on which he knows that a purely artificial value has been placed will take the first convenient opportunity to get rid of them.—"New York Journal of Commerce."

Reference Drawings.

Manufacturers of machinery which, though of the same general type, embodies more or less special features in the different contracts executed, find the construction of new designs greatly facilitated through the preservation for reference of copious data upon old ones. The system followed by the Watson-Stillman Company, New York, is worthy of imitation. Here it is the practice to preserve a reduced blueprint of every drawing used in the shop. These blueprints, about 8 by 10 inches in size, are bound together in albums and kept for ready reference. The manufacturer has thus conveniently at hand drawings of a far more varied assortment of machinery than can be illustrated or described in his published catalog, and albums thus arranged are far more convenient for reference than full-sized drawings can be, no matter how filed.

The New Era Gas Engine.

The New Era Iron Works Company, of Dayton, Ohio, was organized in 1894, and grew out of what was originally Pease, Clegg & Co., the "Co." being Mr. James R. Johnston, father of Mr. Lawrence Johnston, the present head of the company. Pease, Clegg & Co. began in 1857 the manufacture of tools and general machinery. In 1876 the firm became James R. Johnston & Son. A 10-foot vertical boring mill still in daily use was built by Mr. Johnston in 1867. It is probably the first machine of this kind with the common friction disk used for feeding the cutting tool.

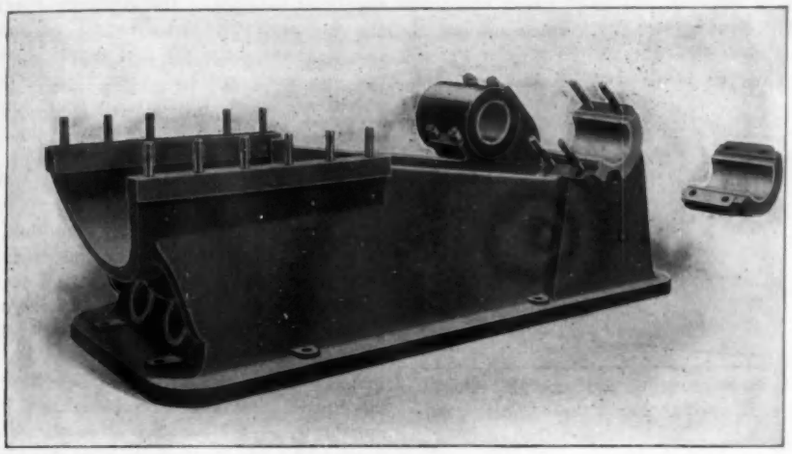


FIG. 1. FRAME OF 125 HORSE-POWER NEW ERA GAS ENGINE.

Mr. Lawrence Johnston has spent most of his life in these shops, and as a practical inventor and designer of a great variety of special tools and machinery has been very successful. Mr. Johnston has a fund of reminiscences of the trials and tribulations of early manufacturing experiences in Dayton. Years ago, when English steel held supreme sway among the tool makers, Mr. Johnston's father decided to try some American steel made by Mr. Gatley in Pittsburgh. Some sample bars were taken to the tool smith, who promptly rejected them as very inferior stuff. Mr. Johnston hunted up some English labels, which he pasted on the same bars, and again brought them to the same tool smith, and the steel was found to be of excellent quality.

Without the intention of going into the regular manufacture of gas engines, Mr. Johnston built one for his own use in 1891, which turned out so well that he received orders from several local concerns. This proved so promising that it was decided to turn the works into the gas-engine business, and now 60 to 100 men are employed entirely on this work.

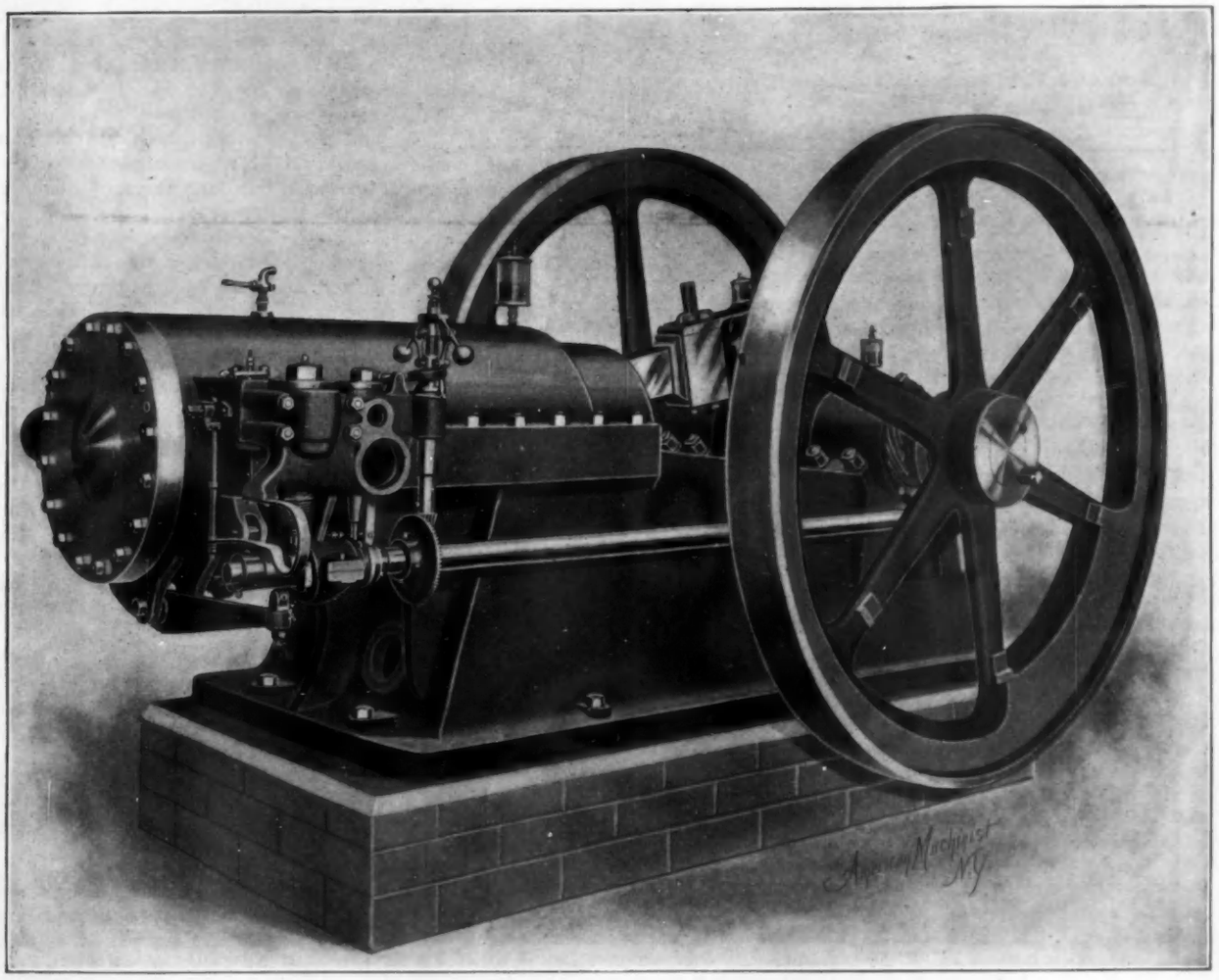


FIG. 2. NEW ERA 125 HORSE-POWER GAS ENGINE.

A specialty is made of large engines. Fig. 2 is a 125 B. H. P. engine running at Pittsburgh on natural gas. This is believed to be the largest single cylinder en-

gine in America. The main dimensions are:

Cylinders—20x30 inches.
Main journals—8x15 inches.
Crank pin—8x8 inches.
Piston head—20x31 inches.
Wrist pin—3 15-16x6 inches.
Compression—65 pounds.
Revolutions per minute—150.
Total weight—26,000 pounds.

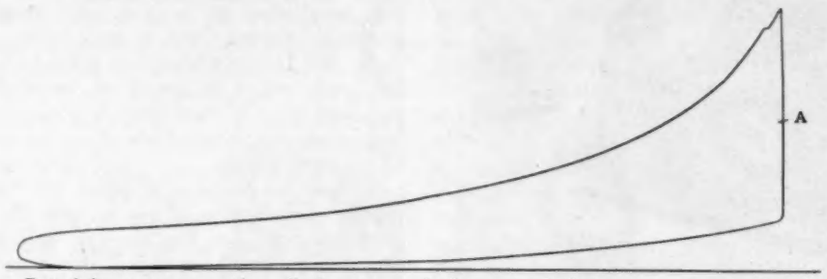
Whenever the engine is stopped it is made to pump air into a storage tank to a pressure of about 70 pounds per square inch. This air is stored until the engine is to be started. The engine is turned slightly over the center, and a passage opened between the combustion chamber and the storage tank. A small amount of gasoline is placed in this passage and compressed air is allowed to flow into the cylinder until ignition is effected. A check valve prevents the pressure of explosion from going back into the tank. In this way, after a little practice, an operator can start the largest engine with ease and precision. In the large engines Mr. Johnston tapers the piston head slightly toward the rear end, where the expansion is greatest. This prevents binding when the engine is fully heated up.

The speed of the New Era engines is regulated by making the governor control the fuel valve. Under excess of speed the governor stops the fuel supply during one or more cycles. Conical cast-iron valves are used, which have been found by Mr. Johnston to be more enduring and satisfactory than any other.

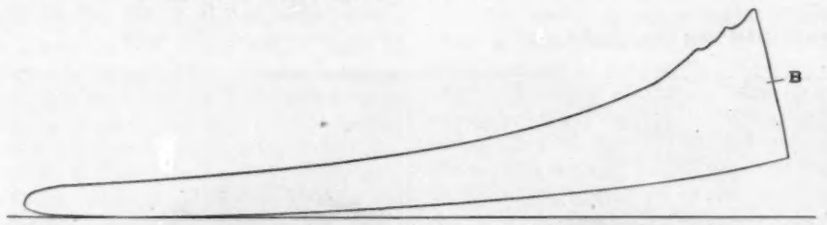
Fig. 4 shows a cylinder with the water cover removed. The cylinders are cast with a hole in the end large enough to clear the boring bar. After the cylinder is finished, this hole is filled with a screw plug, effectively sealing the end of the cylinder. Here, then, the difficulty of packing cylinder heads on gas engines is obviated. These cylinders are bored on a lathe fitted up with a special carriage. The smaller sizes are bored with a stationary cutting tool, the carriage feeding the whole cylinder. The larger sizes are held stationary on the carriage, while the cutting tool travels along the boring bar. The valve seats are bored and reamed on a special combination milling and drilling machine designed by Mr. Johnston. All engines are erected and tested on the same blocks; which is both convenient and economical. Mr. Johnston constructs his own spark coils, and they are wound on a self-acting machine.

Fig. 5 is a convenient device used in this shop for turning governor balls. *e* is the ball supported on lathe centers; *a* is a spur wheel carrying tool *f*. The center of this wheel is directly under the center of the ball. This wheel meshes with wheel *b*. Wheel *b* is turned with crank *c*. *h* is the base-plate, which is bolted to the carriage by *g g*. It is clear that the tool *f* will form the ball into a true sphere.

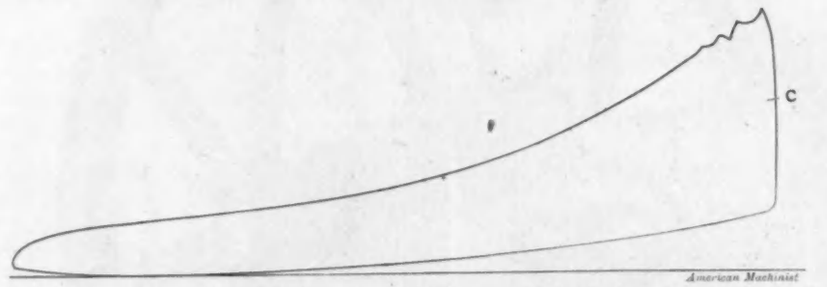
As an indication of the low cost of power with natural gas at 25 cents, these shops are driven by a 35 B. H. P. engine. There is also a 15 horse-power electric light engine, and the cost of fuel is from $10 to $15 per month.



Rated horse-power, 16; cylinder, 9 x 14 inches; revolutions, 200; compression, 60 pounds; maximum pressure, 360 pounds; scale of spring, 200 pounds; fuel, gasoline; mean effective pressure, 90 pounds; full load.



Rated horse-power, 16; cylinder, 9 x 14 inches; revolutions, 200 per minute; compression, 60 pounds; maximum pressure, 250 pounds; scale of spring, 200 pounds; fuel, natural gas; mean effective pressure, 76 pounds; full load.



Rated horse-power, 80; cylinder, 18 x 26 inches; revolutions per minute, 160; compression, 65 pounds; maximum pressure, 300 pounds; scale of spring, 200 pounds; fuel, natural gas; mean effective pressure, 115 pounds; full load.

FIG. 3.

It is common opinion that something dreadful will happen when large gas engines are proposed. Mr. Johnston would build a 500 horse-power engine with as little fear of success as a 50. The increase of thermodynamic and mechanical efficiency is even more decided in the large gas engines than in the large steam engines. Fig. 3 shows Cards A, B, from a 16 horse-power engine with M. E. P. of 90 pounds with gasoline and 76 pounds with natural gas. Card C is from an 80 horse-power engine with M. E. P. of 115 pounds on natural gas. This engine tested over 89 B. H. P. The compression is about 65 pounds. The dotted line is the adiabatic expansion laid off by the writer, on the assumption that the compression was adiabatic, which is not strictly true.

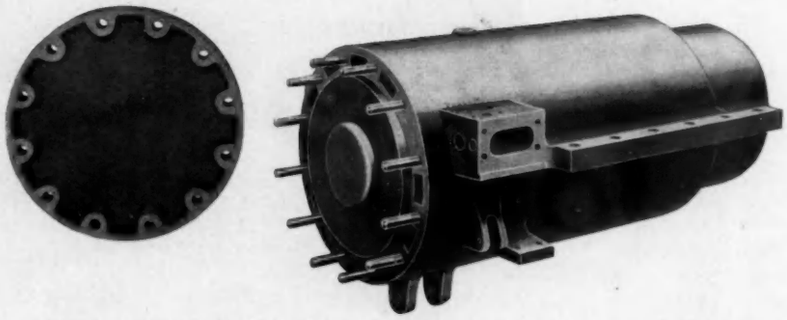


FIG. 4. CYLINDER OF NEW ERA GAS ENGINE WITH WATER COVER REMOVED.

Fig. 1 is the frame of a 125 B. H. P. engine weighing 8,000 pounds. It is molded entirely in green sand, excepting cores for the main bearings. The mold is made in a three-part flask. Owing to the

size of the cupola, the melted iron had to be drawn off in three heats, taking in all 80 minutes. The first two pourings were lagged on the sides and covered on top with charcoal. The casting was completed without a flaw. B. A.

The Metric System.

During the past few months there has been much written in our religious contemporaries on the old scholastic definitions of "the substance" and "the accident." Although dealing with very different subject matter, these articles may be recommended as a matter for study to some of the persons who have lately been writing to the "Times" on the metric system. Many of them get into dire confusion between the essential substance of that system and its accidental connection with the decimal notation. These are two matters which need to be kept entirely apart. The principle of the metric system has nothing whatever to do with division by ten, or by any other number. It lies solely in the use of only one fundamental unit for measures of length, of capacity and of weight. One would think that this beautiful simplicity would recommend it at the first glance to all the world, and that not a single voice would be raised against it anywhere. No one can be so dense as not to be able to understand its main features in two minutes. In the decimeter—any other name would do as well, or better—we have a convenient standard of length. A cube of this dimension furnishes the unit of capacity, the liter, while the weight of a liter of water is the unit of weight, the kilogram. That is the whole of the metric system, and is passes the wit of man to devise one simpler or more convenient. As compared with it, our system of weights and measures is complexity itself.

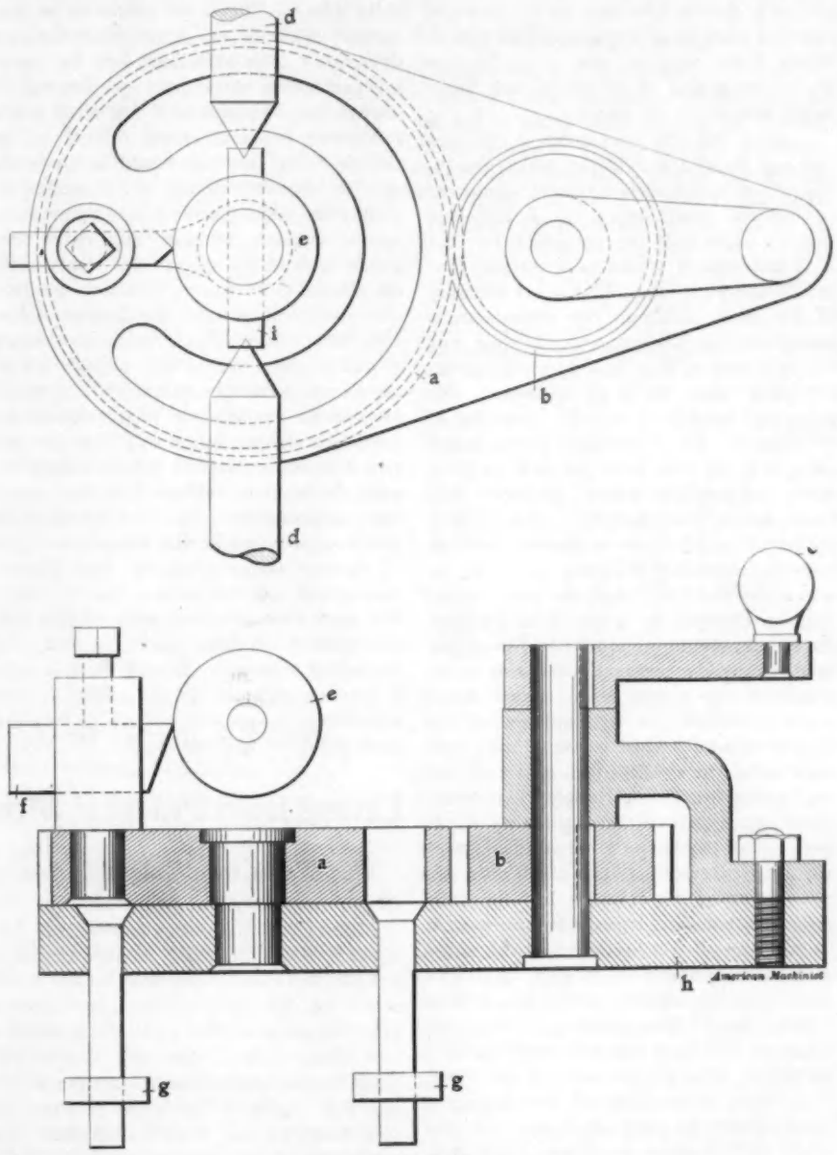


Fig. 5

DEVICE FOR TURNING GOVERNOR BALLS.

When the metrical system was adopted in France there was associated with it the decimal notation. The men who reconstructed the calendar, who devised and destroyed a dozen constitutions, and who solemnly deposed the Almighty by resolution, had not the courage to introduce a new basis of numeration. They felt that even the logical Gallic mind would recoil from a change so radical. They knew that it was impossible for them to have two concurrent systems of notation, while to write the multiples and sub-multiples of the metric system in parallel columns, as we write tons, hundredweights, quarters and pounds would have been to wilfully sacrifice a great part of its advantage, since it would have involved a jumble of the decimal and duodecimal systems. It was not their fault that they had to count by tens; that method was in full operation in the age of the river-drift man, and probably long anterior to that. A custom which goes behind the earliest records of humanity is not to be shaken to pieces even by such a moral earthquake as the French Revolution.

Some three years ago Mr. Herbert Spencer wrote a number of articles in the "Times" combating the adoption of the metric system until such time as the duodecimal system could be introduced concurrently. During the present discussion the same views have been advanced by a correspondent signing himself "Citizen," to whom the editor gives the honor of large type, and who is probably a philosopher of the same school. Now, to gentlemen who are accustomed to survey mankind from the standpoint of evolution, and to trace changes in manners, habits and customs extending over thousands of years, the few centuries needed to educate the world up to the point of abandoning the decimal system may appear a small matter, and it may seem to them worth while to put off reforms until they can be made thoroughly. But to those of us who are mainly concerned in finding bread and cheese for ourselves, and in getting our children established in the world, such very comprehensive views appear somewhat vague. We are not content to put off a very desirable change, which would be of immediate benefit to ourselves, in order that our distant descendants may inaugurate an ideally perfect scheme. Any stick is good enough to beat a dog with, and some people think any argument good enough to fling at the metric system. "Citizen," in his letter which appeared in the "Times" of April 4, said: "The metric system does not fit our time measures, natural or artificial. We have twelve full moons in a year, and cannot make ten months agree with them." Can absurdity go further? The metric system has no relation to time; it deals only with length, area, capacity and weight. Further, it is somewhat remarkable to see the statement that there are *twelve* full moons in the year given in large type in the "Times." No wonder

"Citizen" finds the metric system difficult of comprehension when his powers of observation are so poor as not to have shown him that the full moon does not always fall on the same day of the month. His other objections, that we cannot have ten hours in a day, or 100 degrees in a quadrant, or ten points in the compass, are equally unrelated to the metric system, although they are quite correct as facts. No reasonable person wants to decimalize everything, and most of us are quite in agreement with Mr. Herbert Spencer in his advocacy of the duodecimal system. The divergence between us lies in our disinclination to let the adoption of the metric system wait for that of the duodecimal system. If our great-grandchildren choose to divide the meter into 144 parts they will be free to do so; but that is no reason why we should not use the measure in the meantime.

"Citizen" says, "Learning the new notation in schools does not seem more difficult than learning the metric system." Now although the duodecimal system is simple enough, yet we think it would be found almost impossible to get the public to understand it. The man in the street has no conception that any other basis of notation than 10 is possible. The idea has never occurred to him that 100 can represent a gross, or that 1,000 can mean the same that 1,728 does now. He can readily understand that 9 meters are about equal to ten yards, and that a kilogram is practically 2¼ pounds, and he can carry in his mind the simple multipliers necessary to make, with sufficient accuracy, the conversion from metrical to British units. But there is no multiplier or divisor by which figures can be readily converted from decimal to duodecimal scale in the mind. The proportion between 100 and 144 is not the same as that between 1,000 and 1,728, or between 10,000 and 20,736, and yet these pairs of figures are equivalents in the two scales. It would be a long business for an adult man to accustom himself to think both in the decimal and duodecimal scales, while it is a simple matter to train oneself to use inches and millimeters indifferently.

Far too much is made of the difficulties of the decimal system. We find it perfectly sufficient for reckoning all large quantities, and it is only when we come to small ones that we change the basis of our notation. We do not reckon our money or our weights in grosses of pounds or of tons. Our smaller standards, it is true, are on other bases, but these do not follow any intelligible system. We have 14 pounds to a stone, 5½ yards to a rod, 437½ grains to an ounce, 7 days to a week, 66 feet to a chain, 28 to 31 days to a month, 37.06 inches to a Scotch ell, 5 quarters to a load, 9 gallons to a firkin, 20 hundredweight to a ton, and so on. Evidently our measures were not devised with the idea that they should all be divisible by 2, 3 and 4. Some, of course, were, but that was greatly due to the fact that they were arrived at in the times when measuring instruments were very crude, and it was not possible to rely on the fine subdivisions. Now a quarter of a meter can be measured as easily and accurately as a quarter of a yard, and 150 grams can be weighed as closely as 4 ounces. The human mind is not nearly so hide-bound as the opponents of the metrical system seem to suppose. The French housewife does not ask the grocer for 500 grams of sugar or 250 grams of coffee; she demands a "livre," half kilo or a quarter kilo, just as her sister in England asks for a pound or a half pound. Below these weights she buys by 100 grams, 50 grams or 25 grams, the latter being practically an ounce.

A great deal has been made in the controversy about the difficulty which the introduction of the metric system would entail on the small buyer. It is admitted that it might suit the manufacturer, but it is said that it would be a terrible burden to the poor man. The exact contrary is the case; although the manufacturer would reap an advantage in the long run, the first cost to him would be very great, especially when he is an engineer. The poor man would scarcely be conscious of the change. The tradesmen would weigh his goods for him with the new weights, while competition would preserve him from being overcharged. His weekly packet of tea, tobacco or butter would be scarcely noticeably different from that he was accustomed to, while the price would only be changed by a fractional amount. At the same time he would be the gainer by getting more constant work, due to increase of our export trade, which would certainly follow the introduction of the metric system. Our exports last year were valued at £364,000,000, nearly all being invoiced in British weights and measures, and much of them going to countries where those weights and measures are not understood. At a time when we are scrambling for markets, and the daily press is constantly urging the government to back up their negotiations by a show of force, it seems most illogical to let our trade fall into German hands, as our consuls are ever telling us we are doing, because we will force our own national units on people who do not understand them. If it were a question of abandoning a good system to take up a bad one, we might well hesitate to do so. But it is the universal testimony of Englishmen who have gone to manage works abroad, that the metrical system is far superior to ours. Engineers who have got into the habit of designing in millimeters never take kindly again to inches, with the subdivisions of eighths, sixteenths and thirty-seconds. Foreign commercial men stand aghast at the heavy work of our counting-houses, while scientific men have long since been forced into the habitual use of the metric system.

The change from British to metric measures would be expensive to engineer, but it is very easy to exaggerate its cost. We are told that it would involve entirely new patterns and jigs. This, of course, is absurd. Castings are not made to exact sizes; it is only in special cases that any one dreams of measuring them. Even when they have to be planed and finished, a dimension in millimeters can always be found which does not differ from the original British dimension by more than 1-25 inch, and generally by not more than 1-50 inch. We should be very glad to think that all the work produced in this country was correct within that limit of deviation. The allowance left for turning and boring in castings and forgings is always large enough to allow of an extra millimeter being taken off or left on, as the case may be. It would be perfectly easy to take the castings and forgings for a marine engine and finish them to a metric measure without any extra expense, except for gages. In small work the change is, of course, relatively greater, but, on the other hand, the gages and jigs cost less. We do not wish to unduly minimize the expense and trouble which an alteration to the metric system would involve for engineers. We know that it would be serious, but seeing that the system has been adopted spontaneously by some firms, it is evident that the advantages outweigh the cost. The matter could not be undertaken during the present flush of activity, but during the next depression it will call for serious consideration. We shall find ourselves with high wages and greatly increased plants, in face of a dwindling demand. It will then become a question whether we can afford to give advantages to our competitors, as we have been doing.—"Engineering."

Letters from Practical Men

The Work the Windmill Does.

Editor American Machinist:

Although not a manufacturer of, nor in any way interested in, windmills, I believe that Mr. Tecumseh Swift in his article on "Windmill Inefficiency" does a great injustice to that (I was intending to say useful animal, but will not call it that) almost indispensable machine, which not only lightens the labor of probably four-fifths of the Western farmers, but cuts down their expenses probably more than any other labor-saving machine which is conducive to their prosperity. The particular duty which has been assigned to the windmill is the pumping of water for stock, irrigation and household use, and to say that it does all that is required of it is the best recommendation that it could have. If the author of the article referred to above had to pump water from a deep well in August weather for a hundred thirsty cattle, I am inclined to think he would welcome a wind-

mill that would do the work, its inefficiency to the contrary notwithstanding. As the wind costs nothing you do not waste it by throwing the mill out of service, any more than you would waste wind by not buying a windmill to utilize it. The wasting of power by throwing the vanes of a windmill at an angle with the wind reminds me of the boy's essay on pins, in which he says, among other things, that they had saved many people's lives, and upon the teacher asking him how, he replied, "by their not swallowing them." But, to return, the windmill must have some automatic device to stop it; first, when the tank (if it is running a pump) is full, and secondly, when the velocity of the wind is too high, to prevent it from running away and destroying itself. In the latter case the governor acts like a safety valve on a boiler, and I am quite sure Mr. Swift would not try to save steam by dispensing with the safety valve.

Windmills run fast or slow, depending on the wind, and the work done is in proportion to the speed, even with a fixed stroke in the pump. When the work of the mill is done (the tank being full) it automatically stops, and thereby saves wear and tear, the only expense outside of first cost. Under no circumstances can I think of a better method of using wind power than to have the governor so adjusted that the mill will not run away in a high wind and will stop when its task is done, and efficiency cannot be taken into consideration if it does the work it is purchased for and weathers the storm.

C. E. SARGENT.

Chicago.

Good Enough Windmills.

Editor American Machinist:

Tecumseh Swift's arraignment of the windmill, in the last issue, seems too absurd to be taken seriously. Mr. Swift has possibly failed to study those editorials upon "good enough" machinery, which have appeared in the "American Machinist" from time to time. One would suppose that in the good old times when he was running machine tools up in New England, if they had a freshet, in place of letting the surplus water over the spillway, he speeded up the tools and took deeper cuts, simply to save the power flowing away, and regardless of the consequences. The actual working condition of windmill installation is that two or three hours per day is the limit of their use. Almost as bad a nuisance as a lack of water is an over supply and a mud hole around the drinking tanks; so that a great deal of labor and inventive work have been expended in keeping the windmill from doing too much under its present construction and regulation. I am satisfied from an outside point of view that the windmill of to-day is getting more careful study by competent designers to produce a "good enough" machine of the highest grade than is allotted to any one of our common machine tools, such as the lathe or the planer. Like the gas engine, it is adapted to small units, and under its most favorable condition is the cheapest power in the world. Some day in future ages, when the coal supply begins to give out, the windmill, with its electric generators attached, will be as great a benefactor to the human race as in the past it was to the lowlands of Holland; but just now it's a good enough machine for the farmer and the stockman.

OBJECTOR.

Turning Cranks.

Editor American Machinist:

When I saw the article of March 7, in regard to crank-shaft turning by the aid of an eccentric, I felt as if I ought to "make some remarks." But this is a busy time of the year for the country machinist. He makes garden when he can, that is, he gets ready to make it, and is planning for his flower beds and looking over seed catalogs with as much interest as he does the pages of the "American Machinist."

The reason I wanted to make remarks is that for the past twenty-five years the same device has been familiar to me. I think the modern agricultural tools beat all the machines with which I am familiar, in using the crookedest shafts. I enclose sketch of three samples with which I have had considerable to do.

Fig. 1 is one of which I have made a good many, and you will see by the figures that it is quite long, and it is in no place, except the collars, more than 1½ inches in diameter. Both ends, up to the collars, and the two cranks and the center bearing are turned. It is quite a trick to get a true bearing in the center, on which to put the eccentric, Fig. 4, which is in halves, and must be a decent fit in order to clamp on and stay. By running a ring of babbitt on the shaft at the places marked *A* one can, with a sharp tool and fine feed, get a very good bearing to begin work with, and with the center bearing assured the others are comparatively easy. Of course I have suitable dogs on the ends, with centers to give the proper throw to the cranks. This shaft is so limber that it will bend of its own weight. The reason why I used the eccentric, and in halves, was because I could not think of any other way, and that way was right in sight.

I send sketches of two other shafts. Fig. 2 is of wrought iron, 1⅛ inches diameter and perhaps 3½ feet long, and turned nicely in both cranks and at the place marked *A*, and the collars are welded on. Fig. 3 is one that has been very much used, and has been made by hundreds. It is of cast iron, as is also Fig. 1, and is as long as Fig. 2, and the parties who made them did as nice machine work on them as need be done anywhere.

I know of no more helpful and easy way to get a temporary bearing on a long, limber shaft than to run on a ring of babbitt and turn it round. It does not do to pinch it very hard in the steady rest; but if one has a round bushing to put in the jaws of the rest to run it in, it will do excellent service, and it can be left on the shaft until there is no further need of a bearing, and when it is taken off the shaft shows no blemish. I don't know how the shafts Figs. 2 and 3 are turned, but they have been made, to the best of my knowledge, for over forty years, and I surmise that the engine makers are not doing all the thinking.

F. P. AVERY.

Tunkhannock, Pa.

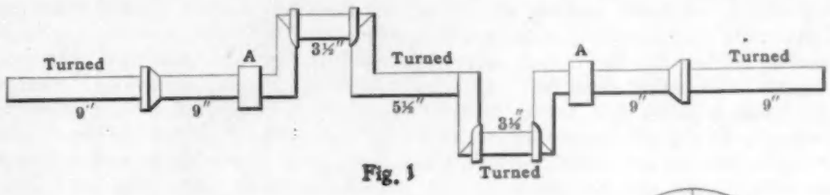


Fig. 1

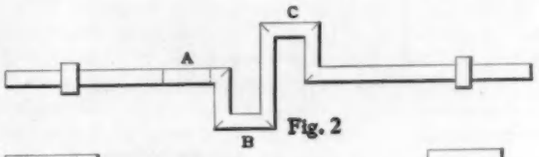


Fig. 2

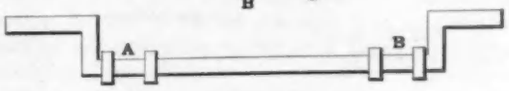


Fig. 3

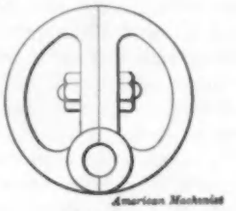


Fig. 4

SOME CRANKS THAT ARE TURNED.

Inconvenient Bills of Foreign Shipments.

Editor American Machinist:

I remark that the American firms neglect, in their bills of parcels, to give marks and details of the packages which are sent off. They content themselves with giving the packages to an express company, which sends them off without any other advice; hence, for the person to

whom the package is addressed, the annoyance to refer again to all the orders.

We think it will be sufficient to have called the attention of those who are interested in the matter, so that, in the future, they may do better in the interest of their customers. H. BOLLINCKX,

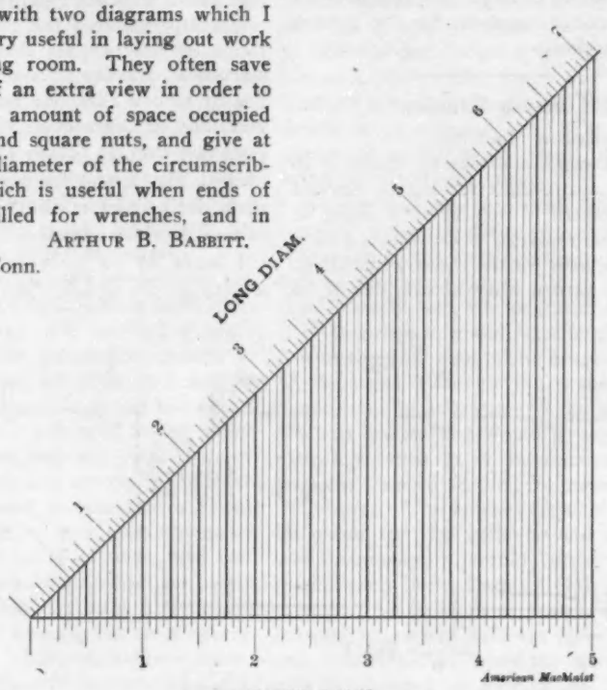
Brussels, Belgium.

Diagrams for Nuts.

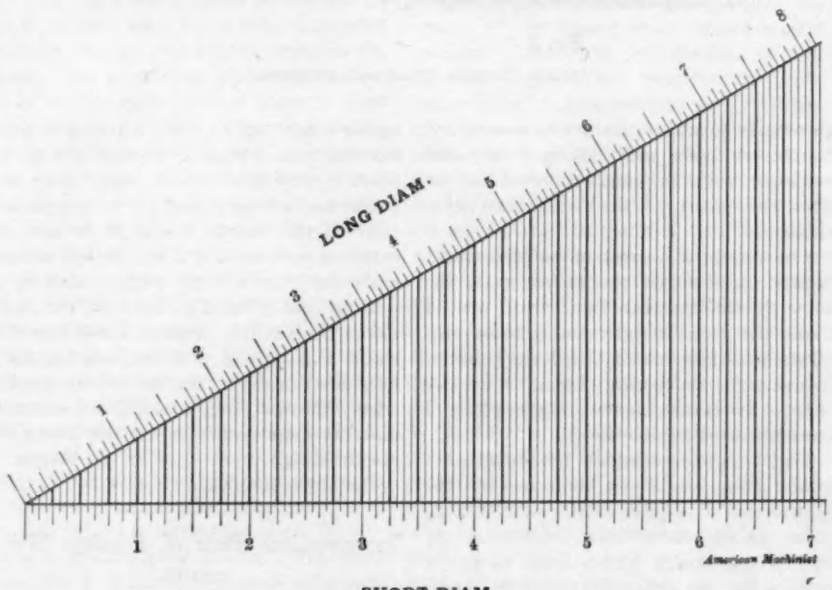
Editor American Machinist:

I send herewith two diagrams which I have found very useful in laying out work in the drawing room. They often save the making of an extra view in order to determine the amount of space occupied by hexagon and square nuts, and give at a glance the diameter of the circumscribing circle, which is useful when ends of shafts are milled for wrenches, and in other places. ARTHUR B. BABBITT.

Hartford, Conn.



LONG AND SHORT DIAMETERS OF SQUARE NUTS.



LONG AND SHORT DIAMETERS OF HEXAGON NUTS.

Courage Which is Folly.

It is to the honor of humanity that courage is not a rare thing. It is not so much to our credit that folly and recklessness are so common. The following from the "Canadian Engineer" is a suggestive narrative of what not to do when similar circumstances occur:

"Early on the morning of March 7 A. Galloway, foreman of a gang of men at the Imperial Oil Company's works, Sarnia, Ont., ordered some of his men to clean out one of the oil tanks in the company's yards. James McCue proceeded down into the tank. When he reached the bottom he was seen by his fellow workmen to fall down. Another workman named John Carter went down to rescue McCue, but no sooner reached the bottom of the tank than he too was overcome by the gas. The foreman, Galloway, was the next to attempt the rescue of the men, and he shared the same fate as the preceding two men. Henry Willis then came to the unfortunate men's rescue, but he, too, was overcome, as was also another employee, named William Brimbs. By this time the alarm had been given that some men were being smothered in a still, and a gang of men from the boiler shops were soon on the scene and proceeded to tear the covering from the still to allow the gas to escape, and thereby make it safe for men to descend into the still. Before this work was completed William McCue attempted to go down the ladder, but when half way down he fell, being almost overcome, but managed to climb part way up again, and was pulled out of the still just in time, as he fainted when he reached the ground. After the covering had been torn away, and the gas allowed to escape, other employees went into the still, and the five men who were lying in a heap at the bottom were hoisted to the top, and all that was possible was done for the unfortunate men. Doctors, who were hastily summoned, worked over the poor fellows from that time until late in the afternoon, when their efforts were finally successful."

"Approbation From Sir Hubert."

"The Inland Printer," which is the leading exponent of the printers' art in America, says in its May issue:

"The office of the 'American Machinist,' New York City, is one of the handsomest printing establishments in America. The composing room contains two linotype machines and a large quantity of hand type. The linotypes are painted white and striped with gold, and the hand type is all copper-faced. The presses are all enameled in white, and the whole place has an air of cleanliness that is not to be found in every printing office. The 'American Machinist' is an office worth going out of your way to see."

"What will you take for your railroad?" said the Belgian Government to the Liege & Mastricht Company. "Thirty million francs," said the company. "We will give you 13,627,500," said the Government. "Done," said the company. The trade was not made in just these words, but that is what it amounted to, and as the shareholders got 700 francs for their 500-franc shares, they perhaps are not to be pitied. This, we believe, was the last of the considerable private railroads in Belgium.—"Railroad Gazette."

There will soon be for sale in this city 337 locomotives of the elevated railroads. As they are running every day they must all be in serviceable condition, and there must be places where many of them could be used, in the yards of big factories and similar places. As the company has no place to store them they should be sold at very low figures.

(*Continued from page 422.*)

thing of the past, with foundries keeping the manganese up to the limits prescribed above, where previously much trouble was due to that cause." The discussion was quite limited. Mr. Kent remarked that the paper was entitled to a much fuller discussion, and suggested that the discussion of it should be continued during the next meeting, and the secretary stated that this would be in order.

Thursday Morning's Session.

The first paper of this session was on

The Equipment of Tall Office Buildings in New York City.

BY REGINALD P. BOLTON.

Several of the largest office buildings of lower New York City have been equipped to the plans of the author of this paper, and he here gives an account of the installation of the Bowling Green Building, the largest commercial office building in the city. Interesting data are given of the vastly increased revenues derived from the modern building over those which it supersedes, and then the costs of the modern structures are spoken of. The cost of all mechanical appliances is about one-seventh of the total, and that of the elevators is about one-third of this. The paper is full of information upon all subjects connected with the construction and operation of the building, all generalized and condensed into handy and useful shape. With the paper are given several plans showing the arrangement of the boilers, engines, generators, pumps, elevators, etc. Some discussion is given as to the relative costs and advantages of using steam and electricity from sources outside the building, but generally this arrangement is not favored, the service from an isolated plant being under present conditions cheaper as well as more satisfactory as regards independence of public service.

The members participating in the discussion agreed with the author on most points. It was pointed out that between electricity from a central station and from an isolated plant the latter had the advantage in the possibility of utilizing the exhaust steam in heating the building, the result being that for northern latitudes, at least, the central station could not hope to compete with the isolated plant except for small buildings where the cost of attendance of an isolated plant is disproportionately high. The subject of fire protection for the large office building was discussed at some length, the opinion being expressed that the pipes installed for this service were usually too small. The use of globe valves in such systems of piping was condemned, and one instance was given in which, through the use of such valves, the velocity of the water was reduced one-half. Some feeling remarks were made regarding the subordination of the engineer to the architect in the planning of these structures—his services being called for only at the last moment, when he had to do the best he could with inadequate provision for the mechanical plant, including an appropriation altogether too small for the installation of an economical plant.

The author in closing the discussion, stated that his own practice had been to make the pipes for the fire service a part of the regular water supply system to insure their being full of water and otherwise in proper order when the emergency requiring their use arose.

The second and concluding paper of the session was entitled

Rolling Mill Fly Wheels.

BY JOHN FRITZ.

At the last meeting of the society, during the discussion of a paper on fly-wheels, Mr. Fritz was prevailed upon to make some remarks, on which we made comment at the time. These remarks having been made without drawings to illustrate the points discussed, Mr. Fritz withdrew them and substituted this formal paper for them. The main features of Mr. Fritz's construction are a hollow rim, numerous arms, and differential lengths of the shrunk-on links at the joints.

Mr. Fritz stated that in the exacting duty of rolling-mill work none of these wheels had ever failed.

It is plain from this paper that twenty-five years ago Mr. Fritz recognized and provided for strains in fly-wheel rims, which have only come to be recognized as existing by others during the past five years or so; and while others have been discussing the efficiency of fly-wheel joints, he has been making them with a strength equal to that of the solid portions of the rim. We regard this paper as the most notable contribution ever made to the subject of fly-wheel construction.

The author of the paper was greeted with a round of applause on taking the floor, and the discussion of the paper was fuller and more animated than that of any other paper presented thus far. The paper being descriptive only, the discussion took the direction of pointing out the good features of the wheel and of showing how perfectly it provided for the most recent analysis of the strains in fly-wheels. Each speaker seemed to find some new point of this kind. One speaker suggested the advisability of making the rim solid and then attaching the arms loosely in order to eliminate the bending strains due to the confining effect of the arms. This, however, the author condemned in closing the discussion. The wheels shown in the paper are of course rim wheels only, and in his closing remarks the author exhibited a design for a band wheel which he had recently made. The author being on the floor, the president called upon him to explain the pattern of pipe joint which he has used with great success—this explanation being intended as a part of the discussion on that subject held during the Wednesday evening session. This joint, it is understood, has been largely adopted in the navy.

Friday Morning's Session.

The opening paper of this session was entitled

The Central Heating Plant of the University of Wisconsin.

BY STORM BULL.

This paper is not a narrative of the original and untrammeled designing of a new plant, but tells rather of the extension, adaptation and correction of a plant already begun. The plant when complete was not considered a model or typical one, but was thought to afford an interesting series of practical problems. The buildings were numerous, they extended over considerable ground, several of them were on a lower level than the boiler house, and the location of the latter was arbitrarily pre-determined by an already existing plant. In addition to other complications the heating plants of the various buildings had been designed by several different parties and required steam of different pressures; the views of non-mechanical trustees as to the limit of steam pressures had to be met; bituminous coal was to be burned with little or no smoke. There were in the complete plant eleven boilers of various types, aggregating 1,160 horse-power. A general description of the plant was given, with some tests of evaporation efficiencies.

The paper was rather strongly criticised in discussion. Mr. Bolton doubted the advisability of the central station system for such conditions, one grave defect being the impossibility of utilizing the exhaust steam for heating purposes. He also condemned the use of two systems of piping, one for high and the other for low-pressure steam. In his opinion but one system of distribution—the high pressure—should have been used, reducing valves being employed locally where needed. He also considered the use of coal handling and elevating machinery of doubtful economy in the circumstances. Mr. Kent thought that Mr. Bolton was not sufficiently specific, and hoped he would embody his ideas in a specific plan before publication in the Transactions. Mr. Kent also criticised the tests of the plant as published, saying especially that the moisture tests of the coal were undoubtedly wrong. In the author's absence, a friend who was fully acquainted with the circumstances, stated that many of the features that had been criticised from an engineering standpoint had been imposed by the authorities, who desired above all else to avoid marring the beauty of the campus. For this reason the plant had been located in an inconspicuous position, and the central plant system had been adopted to avoid the necessity of hauling coal and ashes to the various buildings. The peculiar difficulties growing out of the constantly

changing, and at all times ill defined, policy of public institutions were also dwelt upon. Another speaker described the conditions at the Brooklyn Navy Yard, where a new installation is under consideration, growing out of the recent fire in the main machine shop. Power, heat and light for widely scattered buildings are to be provided, and the authorities have expressed a desire for a discussion of the proper system by the members. The chief reply to this request was by Mr. Baldwin, who pointed out the difficulties and cost of utilizing exhaust steam from central stations owing to the distances to be covered and the large sizes of pipe required. He considered that the proper system comprised a central boiler plant distributing high-pressure steam to the various buildings. With this power should be generated in local stations, the exhaust steam being then utilized where made.

Following this came a paper on

The Power Plant of a University.

BY EDWARD A. DARLING.

This paper deals with the power plant of Columbia University of New York City, and its author has had charge of the installation from the beginning, and is best qualified to give all information concerning it. The paper opens with some general remarks upon universities and education, then gives a sketch of the history of Columbia University, and after that takes up the power and mechanical engineering features. Two entirely distinct plants are described, the first being that of the College of Physicians and Surgeons, which is three miles from the larger buildings and grounds of the university proper. There are here five horizontal tubular boilers, a ventilating and heating system, a refrigerating plant, elevators and auxiliary apparatus, which latter item includes many things, such as sterilizers, culture ovens, an air compressor, and various mechanical devices which require 100 feet of line shafting and keep a first-class machinist constantly employed in making and setting up apparatus.

The buildings and grounds and requirements of the permanent home of the university on Washington Heights are quite fully described, and then the actual power plant is considered in detail. This plant, the writer says, "had to hold its own in a campaign of planning and counterplanning which kept the building on the drawing boards of the architects for a year and a half, finally issuing with a room 165 by 100 feet and 33 feet high in the clear." Four thousand nominal boiler horse-power and 1,500 electrical horse-power were required, with a coal consumption of 15,000 tons per annum. The boilers, engines, generators, pumps and other matters are then enumerated in detail and commented upon. The paper as a whole gives a very full and clear idea of this magnificent installation. The paper is copiously illustrated by maps and drawings.

By the time this paper was presented it became evident that the time was running away, and the President requested all to be as brief as possible in their remarks. The paper received no discussion of moment.

The next paper was on

The Plunger Elevator.

BY GEO. I. ALDEN.

The renewed attention now being given to the plunger type of elevator is given as the reason which has led to the preparation of this paper. It first describes the leading features of the machine and then goes on to consider its meritorious features. The subject of the strength of the plunger considered as a long column is treated both mathematically and in the light of experimental investigation, and following this, consideration is given to the cost of power, operation, speed, repairs, and safety. The conclusions arrived at are distinctly favorable to this type of elevator.

The discussion of this paper consisted chiefly of questions and answers to them by the author, who stated that the system is now being operated under lifts as high as 132 feet, and that speeds of 600 feet per minute have been reached.

Following this came a paper on

Elevators.

BY CHARLES R. PRATT.

This voluminous paper by the elevator engineer of the Sprague Electric Company describes the leading types of elevators and of important details. A large amount of space is naturally devoted to the type of machine with which the author's name is associated. No criticism can be made of this presentation from the standpoint of fairness—the author exhibiting unusual frankness, in fact, in describing some of the trials which have beset him. The paper closes with a section by G. H. Hill, in which the electrical problems and features of electrical elevators are discussed. The entire paper relates to a field of work in which almost no literature exists, and it is of a corresponding degree of interest.

In the presentation of his paper in abstract the author stated that at certain points the effort to secure brevity had led to some misconceptions being formed regarding some of the machines described. The defects of certain types as enumerated were to be considered as hypothetical rather than actual, as in actual service they did well. The difficulties described in connection with his own work were to be considered as historical only.

The only remarks upon this paper were by Mr. Rodgers, who delivered a characteristic and savage attack upon the ball nut feature of the author's machine. Owing to the limited amount of time remaining, the President asked the author to contribute his reply in writing, to which he acceeded.

The title of the next paper was

The Allen Valve for Locomotives.

BY C. H. QUEREAU.

Much discussion has taken place among railroad men regarding the merits of the Allen valve—many regarding it as of no particular value and some considering it as objectionable. Mr. Quereau is a believer in the valve, and proceeds to answer the objections made by those who do not believe in it, and then to give some direct evidence of its superiority over the plain valve.

As it was understood that Mr. Porter was to offer some remarks in discussion of this paper, a large number had assembled to listen to what he should have to say. Mr. Porter's remarks were historical and related to his efforts to introduce this valve in England in 1862, and later in this country. Mr. Avery put it on a traction engine with great success, but was obliged to abandon it because of the adverse opinions of high authorities. Shortly afterwards he made unsuccessful efforts to have it tried on the New York Central & Hudson River and on the Pennsylvania railroads. He considered that Mr. Forney was really responsible for its adoption later, and speaking for himself said that its present wide and successful use was a greater source of personal gratification than any amount of pecuniary returns would have been.

Mr. Rodgers gave the opinion that the valve was not a success without the additional balancing features introduced by Mr. Richardson, and considered this the real reason for its slow progress in its early years.

The concluding paper of the meeting was on

A New System of Valves for Steam Engines, Air Engines, and Compressors.

BY F. W. GORDON.

The valves here described are piston valves placed in the cylinder heads, the line of movement being parallel with that of the piston. Several types of operating mechanism are shown, suitable for releasing gears for engines and for compressors and blowing cylinders. For blowing cylinders the movement is positive—the discharge valves opening at a fixed point—whereas for compressors the positive gear operates to close the discharge valve only—the opening of this valve being accomplished by the air pressure and taking place whenever the pressure in the cylinder equals that in the receiver. The movement of the inlet valve for both blowing engines and compressors is positive, both as regards opening and closing.

Reference letters are entirely omitted from the illustrations, although freely called for in the text, and the paper contains other evidences of hasty preparation.

No doubt these points will be corrected before the paper is put in final form.

By the time this paper had been reached matters were being put through at a railroad pace, and no discussion of importance arose. One paper on "Experiments on Various Types of Fire Hydrants," by Charles L. Newcomb, was not reached. The paper is very voluminous and records a very thorough series of investigations regarding the frictional resistances of numerous types of commercial hydrants. Before the motion for final adjournment, the usual series of resolutions of thanks to those who had managed the details of the convention and had otherwise contributed to its success were passed. These were preceded by resolutions urging upon Congress the importance of providing adequate facilities for the patent office, and of providing fireproof protection to its important records.

EXCURSIONS AND SOCIAL FEATURES.

In the city of Washington a large part of the interest of the meeting naturally centered in the various excursions and other features outside of the regular sessions. A reception to the society by President McKinley was down on the programme for Wednesday afternoon, but the departure of the President from the city prevented this being carried out. In its place the society viewed the public apartments of the White House, and after that made an excursion to the Government cemetery at Arlington. Thursday afternoon was occupied by a visit to the Navy Yard, where the gun factory, trial tank for ship models, and Ordnance Museum were seen. Perhaps the most interesting single feature of the yard was the shop for making the models for the trial tank, where a beautiful pantographic machine is used for reproducing the preliminary model in substantial form for use in the tank. By the aid of this apparatus the complete model is expected to be made in a single day. The tank is very complete in its appointments, some beautiful recording apparatus giving simultaneous records of the speed and pull on the model.

Thursday evening was the occasion of a reception to the society by Mrs. George Westinghouse, which was far and away the most brilliant event of the kind in the society's annals. The house occupied by Mr. and Mrs. Westinghouse was built for Mr. Blaine, and although a mansion in extent was too small for such an event. Accordingly a large temporary addition had been built for the occasion. This addition was lined throughout by white silk draperies, and was otherwise decorated in a manner to completely hide its temporary character. Admiral Schley, General Miles, Mrs. Vinnie Ream Hoxie, numerous foreign ministers, as well as the beauty of Washington *en masse*, it almost seemed, graced the occasion by their presence.

Friday afternoon was occupied by an excursion to Mount Vernon, where a wreath was deposited on the tomb of Washington, with a few brief and appropriate remarks by Ex-President Hunt. Following this an hour or more was spent in wandering about the old mansion.

The excellent care taken of the property should be a source of profound gratification to every American citizen. It is well known that this is due to the Mount Vernon Ladies' Association, and an acknowledgement of the debt which the nation owes to them cannot be made too often.

Friday evening the members visited the Washington monument, from the summit of which a superb view of the city is obtained. In point of beauty, the sight at night is no doubt superior, though from any other standpoint the daylight view is to be preferred. From the monument the programme continued with a visit to the Congressional Library, where a special view was given of the mechanism for bringing the books from the stacks and for conveying them through an underground passage to the Capitol. An invitation to visit the Naval Observatory was received too late to be put upon the programme, but was read during one of the sessions. A few members availed themselves of the opportunity and were well repaid for their efforts by a view of Jupiter through the 26-inch telescope of the observatory.

The ladies accompanying the members were shown many other points of interest during the time of the various sessions. Among the points covered in this way were the Bureau of Printing and Engraving, the Dead Letter Office, the Wagaman Art Gallery, the Halls of the Ancients, and the Capitol.

The register showed 561 members and visitors in attendance, this number being larger than any previous meeting outside of New York. An unusual number of ladies accompanied the members. From the point of view of enjoyment, at least, the meeting was perhaps the most successful ever held. Expressions of satisfaction were very numerous. Many members were not satisfied with the opportunities for sight seeing afforded by the programme, and remained over until Saturday.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(53) W. B. W., asks: Can I find the diameter of a bevel or miter gear blank same as one would for a spur gear by adding two to the number of teeth and then multiplying by the pitch. Or, can you give me a simple rule for finding the diameter of a bevel gear blank without drawing it; or tell me in which issue of the paper such a rule can be found? A.—Multiplying the pitch by the number of teeth plus two does not give the diameter of the blank, but the pitch diameter of the gear is found by multiplying its pitch by the number of teeth. The amount to be added for the total diameter of the blank then depends both upon the pitch of the gear and the number of teeth, and we know of no rule for figuring it except by using in connection with the rule a table. Such a table you will find in a book called "Formulas in Gearing," published by the Brown & Sharpe Manufacturing Co., and you will find a table for the same purpose published in our issue of December 4, 1890, and forming part of an article by Mr. George B. Grant. Usually the simplest and easiest way for finding the diameter of a bevel gear blank is to make a skeleton drawing of it. This can be done very quickly with a little practice.

(54) J. F., Brantford, Ont., writes: Looking through the back numbers of the "American Machinist" I noticed on the drawing of an accumulator that the barrel is marked "Gun Iron 25M lbs. T. S." I have been looking through some of the pocket books, but cannot find in one of them the name of gun iron. Will you kindly give me the composition of the same? A.—The inscription referred to means that the barrel of the accumulator is to be made of gun iron having 25,000 pounds tensile strength, and in regard to the meaning of the term gun iron, until within a few years all gun iron for government work was the product of an air furnace, such as is used for melting iron for malleable castings, and in which the fuel does not come into contact with the iron. Iron made in this way, even if below government standard as to tensile strength, etc., might still have been properly called gun iron because of its freedom from impurities which generally are found in iron melted in the cupola. The two fundamental qualities of what the government recognizes as gun iron for current contracts are a tensile strength of from 28,000 to 39,000 pounds per square inch, and an elongation or stretch of not less than .00025 inch per inch. The iron, however, is the same as ordinary cast iron, and is made from commercial brands, scrap, etc., in such proportions, and melted with sufficient care to produce the above results. The analysis from one furnace might be different from another as regards percentages of impurities, but still the product of both might stand the above named tests and would be accepted. Other parties beside the government might of course specify "gun iron" of less tensile strength and elongation than are required by the government, but if both the government and private parties were to specify simply cast-iron of such and such tensile strength and elongation the result would be the same, and the fact is that the term gun iron to-day has no definite meaning except that it is generally understood to mean a strong, tough and pure iron. Air furnaces are very little if at all used in the production of this iron at the present time.

Personal.

Mr. H. Lasch, manager of the machine tool department of Selig, Sonnenthal & Co., of London, has been visiting here and is now on his way home.

William H. Nisbet, chief mechanical engineer of the Queensland (Australia) Government railways, is visiting this country to see something of its machine shops and its railway management methods.

Mr. Henry J. Hinde, of the Toledo Machine & Tool Company, Toledo, Ohio, recently went to England to negotiate the sale of a number of presses and dies to a large manufacturer of sheet metal wares in that country.

Mr. Sidney H. Wheelhouse, formerly of the M. M. Buck Manufacturing Company, of St. Louis, has recently become connected with the Chicago Pneumatic Tool Company as Southwestern agent, with salesroom and office at 409 North Fourth street, St. Louis, Mo.

Mr. W. H. S. Craven, of Craven Brothers, machine tool builders, of Manchester, England, is visiting here for a month or so with the idea of renewing his acquaintance with American engineers and to see something of our progress since 1882, when he spent four months here.

The Exposition at Philadelphia.

Of the numerous national and international expositions projected for the next three years in different parts of the United States the one to be held in Philadelphia in September, October and November of the present year is in many respects the most important to the commercial interests of the country, for its primary purpose is to foster and encourage American export trade. Not the least interesting feature of the exposition will be the international commercial congress, at which more than 20,000 leading importers and manufacturers from all parts of the world are expected to be in attendance. The business and manufacturing interests of the country already see the benefits to be derived from such a congress, for there will be an absolutely free interchange of opinions on all commercial topics. Not a few foreign governments have appointed delegates to attend this congress and participate in its deliberations. The indications are excellent for an influx of foreign buyers, who will find prepared for their instruction at the exposition an epitome of the productions of the United States of the highest grade and quality. Such a gathering as will be present at the congress—bringing the manufacturers in direct contact with foreign buyers—will be of great benefit and add financial strength and help to increase the sale of products of our home manufactories.

President McKinley will be present at the formal opening of the exposition, and will also address the commercial congress.

A. F. TENNILLE.

Convention of Steam Engineers.

The thirteenth annual convention of the Supreme Council of the American Order of Steam Engineers was held in Philadelphia, May 8-10. The membership of this order is now about 3,500. Its objects are to promote theoretical and practical knowledge in steam engineering, to assist members to obtain employment, to raise the standard of efficiency by bringing about the licensing of steam engineers all over the United States, and to assist its members and their families in the usual methods of beneficial organizations. Several interesting papers of a technical character were read, and the usual routine business was transacted. The Supreme Chief Engineer is Franklin R. Moore, of Philadelphia.

Pittsburgh View of It.

The first big Dewey dinner is to cost $100 a plate. This leads to the suspicion that the meal is to be served off Harveyized armor plate.—"Pittsburgh Times."

Power Consumed by Shafting and Belts.

At a meeting of the Civil Engineers' Club, of Cleveland, Ohio, on April 11, Prof. Charles H. Benjamin read a paper, entitled "The Power Consumed by Shafting and Belts," which was illustrated by lantern slides. The experiments described in the paper were made on the shafting and belts used to drive the machine shop at the Case School of Applied Science, in

(*Continued on page 41.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

The Dutton Wet Twist Drill Grinder is sold by the Garvin Machine Co., New York City.

Patent for sale; thread-cutting thimble; fortune in it. Box 320, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—All issues in January and February, 1898, and copy of May 5, 1898. Address Box 329, AMERICAN MACHINIST.

Wanted—700-lb. drop hammer; Pratt & Whitney preferred. Send cut and full description, with lowest cash price, "Unit," Station B, Buffalo, N. Y.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

For Sale—A fully equipped machine shop enjoying the city trade and all work from surrounding towns. For particulars write The Heer Machine Works, Alliance, Ohio.

We want the contract to build light machinery, tools or models; first class work guaranteed; shop 25 miles out of New York City. Box 310, AMERICAN MACHINIST.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. (postal order) by G. W. Dixon, Spring Lake, Mich.

Wanted—To communicate with manufacturers of Q & C pneumatic hammer, the Boyer pneumatic hammer and Phoenix drill, with view of purchasing. Box 328, A. MACH.

The Waltham Machine Works, Waltham, Mass., make a specialty of accurate work. Correspondence in regard to small automatic machinery, punches and dies, etc., is solicited.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Wanted—A position as a "layer-out" in boiler or tank shop. Box 312, AM. MACH.

Mechanical draftsman with 5 years' shop experience desires change. Address Box 308, AMERICAN MACHINIST.

A foreman pattern maker with up-to-date methods, desires to make a change; 10 years on machine tools. Box 304, AMER. MACH.

Situation as foreman in machine shop; experienced on general machinery, sheet-metal and wire-working machines. Box 307, AMERICAN MACHINIST.

Draftsman, familiar with the designing of steam engines, compressors, ice and refrigerating plants, wishes to make a change. Box 314, AMERICAN MACHINIST.

Mechanical engineer and designer with practical shop experience, in charge of drawing room the last 7 years, desires situation. Box 311, AMERICAN MACHINIST.

Wanted—Position as draftsman with some manufacturing company intending to make up a line of air compressors. Address Box 326, AMERICAN MACHINIST.

An expert cost accountant and shop systemizer is open to a long or short engagement; can check losses and increase gains; write me. Box 305, AMERICAN MACHINIST.

Change wanted, by mechanical draftsman and designer; Conn. or Mass. preferred; 10 years' experience, automatic machinery, tools and fixtures. Address Box 300, AM. MACH.

Pattern maker, young man, wants situation; sober, steady; 12 years' experience, general machinery, brass goods, malleable iron; go anywhere. Address Box 327, AM. MACH.

Middle-aged designing draftsman, familiar with the manufacture of builders' hardware, bicycles, stamping machinery, registers, etc., is open for position; now in Ohio. Address Box 321, AMERICAN MACHINIST.

Change desired by first-class mechanic (36), at present employed as foreman in large general shop, North; have had wide experience in heavy work; a place South preferred. Box 313, AMERICAN MACHINIST.

Wanted—By a young man, a position in office; has had 5 years' experience as buyer and shipping clerk; thoroughly versed in foreign and domestic shipping; references furnished. Address Box 309, AMER. MACH.

Superintendent wishes to change; thoroughly up to date on shop practice and management; experienced on all kinds of electrical and mining machinery, engines, boilers, etc; American; age 40. Box 325, AM. MACH.

Special and automatic machinery (my specialty) designer wants to change; inventions developed; was machinist 9 years, draftsman 6 years; American, age 29, with talent; excellent references; East preferred. Address Box 322, AMERICAN MACHINIST.

A young man, thoroughly experienced on machine tools, having made a specialty of automatic screw machines, and at present holding a responsible position with a large machine tool works desires to make a change;

would prefer traveling. Address Box 318, AMERICAN MACHINIST.

Wanted—A position as general foreman or assistant superintendent, by a thorough mechanic of 20 years' experience, 10 years as foreman; understands estimating; good draftsman; experienced in getting up high-grade medium and light machinery and tools, particularly automatic high-speed wire-working machines. Address Box 317, AM. MACH.

A well-educated, practical, energetic young man with first-class mechanical training and experience wishes position as superintendent or master mechanic; posted in modern practice; has good executive ability; used to managing men; capable of taking charge of erection and equipment of a plant; good business training; progressive and adaptable. Address Box 306, AMERICAN MACHINIST.

Help Wanted.

Wanted—Draftsman with experience in machine-tool building, for shop near Chicago. Address Box 294, AMERICAN MACHINIST.

Wanted—Man with experience on Gisholt turret lathe; state experience and wages expected. Box 323, AMERICAN MACHINIST.

Wanted—Good, all-round machinists on new and repair work; state age, experience and wages expected. Beall Machine Works, Cumberland, Md.

Wanted—In Pennsylvania shop, a draftsman on engines and mining machinery; state experience and salary expected. Box 324, AMERICAN MACHINIST.

Boiler maker, a man to lay out work and assist foreman; must be sober and industrious; a good job to a suitable man. Address Box 302, AMERICAN MACHINIST.

Wanted—Superintendent of machine shop, to take charge of about 75 men; should understand reading drawings and drafting. Address Box 296, AMERICAN MACHINIST.

Wanted—Foreman or assistant superintendent familiar with the construction of gasoline engines. Reply at once to Box 392, Toronto Junction, Ontario, stating experience and salary.

Wanted—A young man (American preferred) as foreman tool-maker in a large hardware specialty establishment; state experience and wages expected. Box 319, AMERICAN MACHINIST.

Wanted—A young man with some technical engineering experience, to travel and sell hydraulic machinery; state age, experience, salary expected and give references. Box 292, AMERICAN MACHINIST.

Wanted—A live, up-to-date machine-shop foreman, accustomed to handling heavy work, principally high-grade modern Corliss engines; state age, experience and salary expected. Address Box 315, AMER. MACHINIST.

Superintendent Wanted — Superintendent for manufactory building steam engines and employing 500 men; must be familiar with modern shop methods; good salary to right man; state experience; give references. Address Box 316, AMERICAN MACHINIST.

Wanted—Foreman for the brass department of a manufacturing establishment, having charge of 20 to 25 men; must be thoroughly up to date in the best practice, understand the making of tools, etc.; state age, experience and salary expected. Box 291, AMERICAN MACHINIST.

Wanted—A young or middle-aged man of good habits, familiar with modern methods of machine practice, to take charge of machine work in a shop devoted to building shapers, located in an Ohio town; state experience and salary expected. Address Box 271, AMERICAN MACHINIST.

Draftsman, hydraulic and mechanical, able to design and execute well-finished drawings, thoroughly posted in details of modern water-wheel construction and development of water powers; permanent position for a suitable man; give references and state salary. Address The Wm. Kennedy & Sons, Limited, Owen Sound, Canada.

Situation as assistant superintendent for Swedish cycle factory, open for a thoroughly good and all-round experienced man, well up in everything concerning up-to-date manufacturing of bicycles, and capable of taking up momentary position as foreman in any of the departments, if required. Applications, stating age, experience, references and salary expected, Box 303, AMERICAN MACHINIST.

Wanted—Young man of technical education who has had experience in superintending power plant and repair shops of large manufacturing establishment; must have good executive ability and be able to handle men; experience on experimental machinery also desirable. Address, giving references, experience and salary expected, Kodak Park Works, Eastman Kodak Company, Rochester, N. Y.

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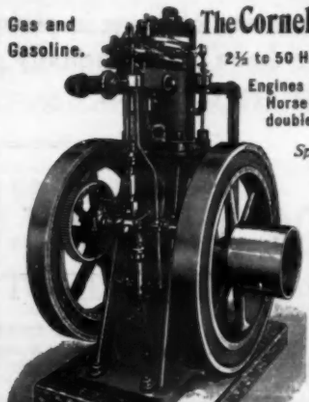


Write for our Special Advertising Price.

Coal Handling Machinery Co.,
76 Pratt St.
Chicago, Ill.

(*Continued from page 40.*)

Cleveland, by the aid of a Flather recording dynamometer. In these experiments the horse-power required to drive the shaft alone was found to be about one-third that required for shafting, belts and loose pulleys.

Enlargement of the Kempsmith Machine Tool Works.

The general state of activity in the machine-tool business is reflected in the numerous enlargements of existing tool-building shops, news of which reaches us from time to time. The most recent piece of information of this kind to reach us relates to the Kempsmith Machine Tool Works, of Milwaukee, Wis., who have an enlargement in progress that will about double their output. The new building is now practically completed.

Not everyone has happened to think, perhaps, of the increase in the duties, cares and responsibilities of the stationary engineer that has come to him with the general adoption of electricity. He used to sit all day long by the side of his long-stroke, slow-running engine, occasionally shovelling a little coal, or stopping or starting the feed pump, and with nothing else to trouble him. Now nearly every engine room has its lighting dynamo, with usually its own engine, and the number of factories using electricity more or less for power transmission is constantly on the increase. It is noted that the engineer of the Pencoyd Iron Works has, in addition to his other duties, to superintend the operation of 220 electric motors running machines, besides the extensive arc lighting of the establishment.

It seems that in England along with their employers' liability law they have also one which holds workmen responsible for failure to maintain and use safeguards provided by their employers. Under this law a sawyer was recently prosecuted in Manchester for neglecting to maintain the guard of a circular saw, which guard had been provided by his employer after an accident in which a boy had been decapitated. The workman was fined five shillings and costs, and an engineer employed by another firm was fined forty shillings and costs for neglecting to maintain the fencing around a gas engine.

Not because it seems rather to favor the metric system, but because it seems devoid of hysterics and imbued with much of common sense based on experience and purely utilitarian considerations, we print elsewhere in this issue an editorial article from "Engineering" of London, on "The Metric System." It is instructive in various ways, and well worth reading, not only by those who actually measure and weigh things, but by those who are inter-

ested in the development of our foreign trade in machinery, and there is much in it that is significant of the trend of events abroad with regard to the international system.

An international competitive exhibition of motor carriages, open to all comers, is to be held at Exercier-Haus, 34 Carl Strasse, Berlin, Germany, from September 3 to 28 next. The exhibits will comprise motor carriages and devices of all kinds for the transportation of persons, for fruit, motor cycles and trailers, and in fact all articles relating to the design and construction of motor vehicles.

We are informed by a member of the United States Commission to the Paris Exposition of 1900 that about 80 per cent. of the total iron work for the buildings of the exposition is now in place, and that the staff or o tside covering is being placed on those buildings which are near completion.

Among the recent things done by the Diamond Machine Company, of Providence, R. I., is the construction of a strap polishing machine, made for polishing the keel of the new cup defender.

Technical Publications.

"Lubrication and the Testing of Oils." By G. W. Bissell, M. E. Published by the author at Ames, Iowa.

In this pamphlet Prof. Bissell has given us in convenient form most of what the user of oils wants to know about testing them, and the means of arriving at a correct conclusion as to their relative merits for his use.

"Air-Brake Diseases; Their Cause, Symptoms and Cure." By Paul Synnestvedt. A revision of "Diseases of the Air-Brake System," by the same author. 127 5x8 pages; 34 illustrations. Chicago. The W. F. Hall Printing Company.

This is not only a revision, but is also a bringing up to date of matter first published several years ago. It is written by a man thoroughly and practically acquainted with the subject and will undoubtedly prove useful to all who have to do with handling or keeping in repair the mechanism of which it treats.

"Liquid Air and the Liquefaction of Gases." By T. O'Conor Sloan. 365 5½x7¾-inch pages, with numerous illustrations. Norman W. Henley & Co. Price, $2.50.

This is an extremely readable book, giving as it does the story of the liquefaction of gases from a historical, biographical and scientific standpoint. A large but not too large amount of space is given to Faraday's early experiments in the liquefaction of gases. Chronological accounts

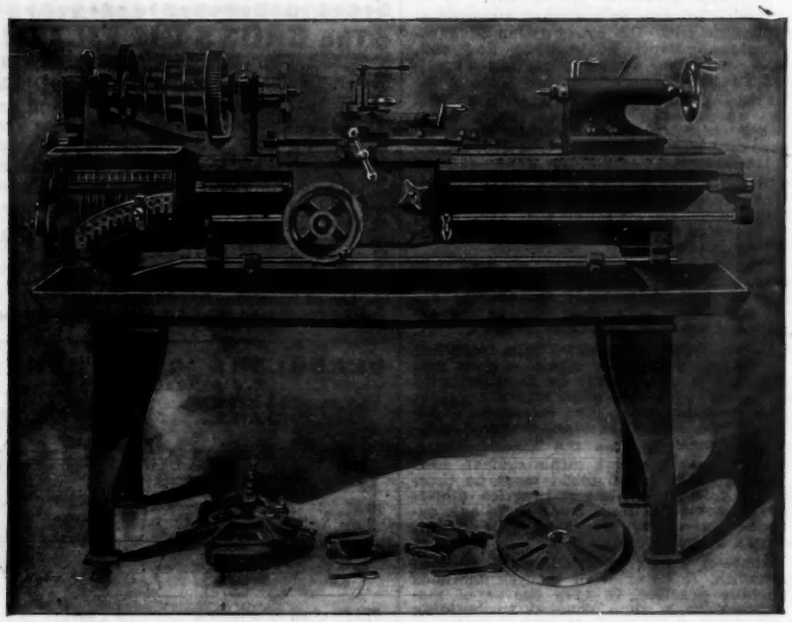
(*Continued on page 43.*)

The Hendey Machine Co.

TORRINGTON, CONN.

This Company is the sole owner of Letters Patents Nos. 468,183, 470,591, 519,294, 549,006 and 557,031, granted to P. & W. Schellenbach, W. P. Norton, and W. L. Schellenbach, for Improvements in Engine Lathes.

We take this method of notifying the public that we have already commenced suit against infringers of these patents, and that should it be found necessary to the protection of our rights, additional suits will be brought against manufacturers, vendors and users of infringing lathes.



The merits of these improvements have been widely recognized and have been wantonly copied. We shall take vigorous steps to protect our own.

The Hendey Machine Co.,

TORRINGTON, CONN.

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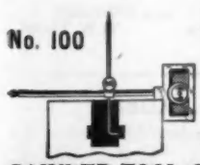

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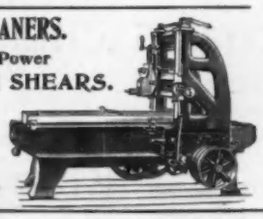

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(*Continued from page 42.*)

are also given of the work and methods of various successful experimenters in this field, together with biographical sketches. The possible applications of liquid air are set forth in more moderate language than many writers have used, though not so moderate as the present outlook demands. The scientific treatment leaves much to be desired, but much of this would be skipped by the average reader in any event. The account, considered as a narrative, is well written, is full of interest, and may be read by any reader of intelligence, while the greatness of the achievement in a scientific sense, and of its importance in furthering research in numerous other fields are set forth more clearly than we have before seen it done. The liquefaction of air is an achievement which appeals so strongly to the popular interest that the book will no doubt command, as it deserves, a large sale, and in its turn it will aid in stimulating popular interest in scientific matters.

Among the new journals which seems to be well received and to give evidence of a kindly reception is one called "Accountics," which is devoted to office matters, particularly those connected with manufacturing operations. It is published by the Accountics Association, 25 Pine street, New York City.

The sixth annual oyster roast given by the Berlin Iron Bridge Company, of East Berlin, Conn., to its employees and their families was held on the evening of April 26 at the factory of the company. There were visitors from a large number of the other towns of the State, it being estimated that about 2,500 guests were present. Music for the occasion was furnished by the band connected with the works, and the occasion was, as usual, a very enjoyable one.

It is announced from Pittsburgh that there will be no summer shut-down in the iron and steel mills this year. Manufacturers are already far behind their orders, and a shut-down would mean loss of trade. Therefore, contrary to the usual routine of wage settlements, conference on the new lists will be held in Detroit immediately after the adjournment, May 30, of the National Convention of the Amalgamated Association.

A correspondent of "The Engineer" refers to "tin-plate bridges like those of the United States." He is evidently exceedingly displeased with us.

Manufacturers.

The Tarboro (N. C.) Cotton Factory will commence at once the erection of mill No. 2.

Work has been commenced on the new factory of F. A. Walsh at South Water and Reed streets, Milwaukee, Wis.

The Michigan Wooden Pipe Works, Bay City, Mich., were recently destroyed by fire, entailing a loss of about $30,000.

Townsend, Grace & Co., Baltimore, Md., are to make improvements to their plant involving the expenditure of $45,000.

The C & C Electric Company has opened a new office at 828 Monadnock Block, Chicago, with Mr. E. Sanderson in charge.

At Fostoria, O., the Seneca White Lime Company is to erect a new plant. The incorporators of the new company are W. S. Sutliff, C. E. Palmer, W. A. Jones and M. C. Briggs.

The property of the United States Tobacco Company, Richmond, Va., has been sold to a party of gentlemen headed by Mr. Thos. B. Scott, secretary of the J. Wright Company. The new company will make extensive improvements to the plant.

The Berlin Iron Bridge Company, of East Berlin, Conn., is putting up a new machine room for the Duncan Company, at Mechanicville, N. Y. The building is 72 feet wide, 170 feet long; the roof trusses being arranged with trolley beams and hoists, so that the rolls of paper can be lifted in and out of the machines by power.

A. G. Winter of the Marsden Cellulose Company, recently returned to New York and stated that it is the intention of his company to erect a new factory at Newport News, Va., to cost about $1,000,000. The company now works plants at Rockford, Ill., and Owensboro, Ky., but these will be branches of the Newport News plant, which will be the general headquarters for the company's business.

The organization of the Gruson Iron Works has been completed by the election of the following officers: President, P. H. Griffin; Vice-President, C. W. Barnum, of Lime Rock, Conn.; Treasurer, T. Guilford Smith, of Buffalo, N. Y., and Secretary, Capt. Piorkowski, of this city. The company proposes to erect a plant somewhere near New York Harbor. It is proposed to manufacture what is known as the Gruson turret and also all kinds of chilled castings.

H. C. Bradley is making arrangements for the new factory which he intends to put up at the corner of Oak and George streets, Bridgeport, Conn. This building will embody many new ideas. It will be 50x190 feet in ground area, two stories in hight, and will have a basement. A boiler and an engine of 100 or 150 horse-power will be installed, and the factory will be provided with a complete system of electric lights.

Owing to the increase of business of the National Cash Register Company, of Dayton, O., the following additions are to be made at once to the plant: Two full stories are to be added to the present four-story brick and steel "Machinery Hall," which building is 350 feet long and 50 feet wide. A new five-story and basement manufacturing building, 360 feet long and 60 feet wide, latest improved brick and steel construction, is to be erected. An addition is to be made to the brass foundry which will double its capacity, the whole to be equipped with the very latest foundry appliances. An additional 650 horse-power tandem compound engine, to run condensing will be installed. It will be direct connected to a 485-kilowatt direct-current generator running at 280 volts.

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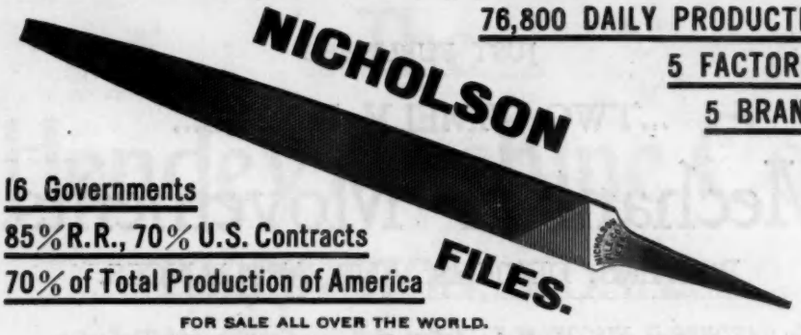

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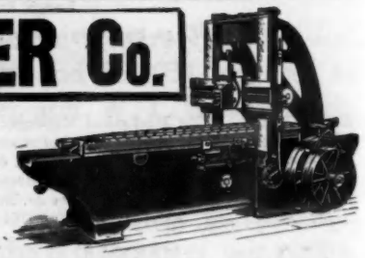

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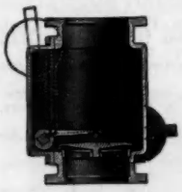

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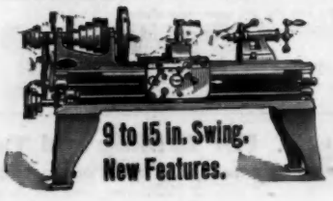

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